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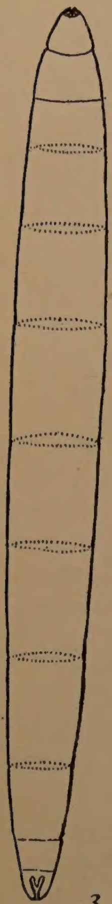

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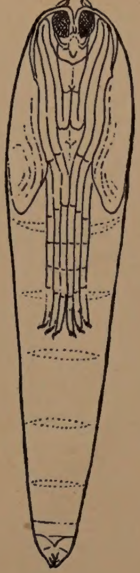

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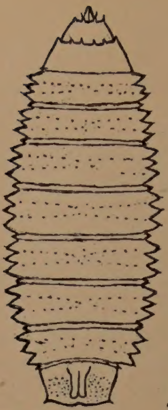

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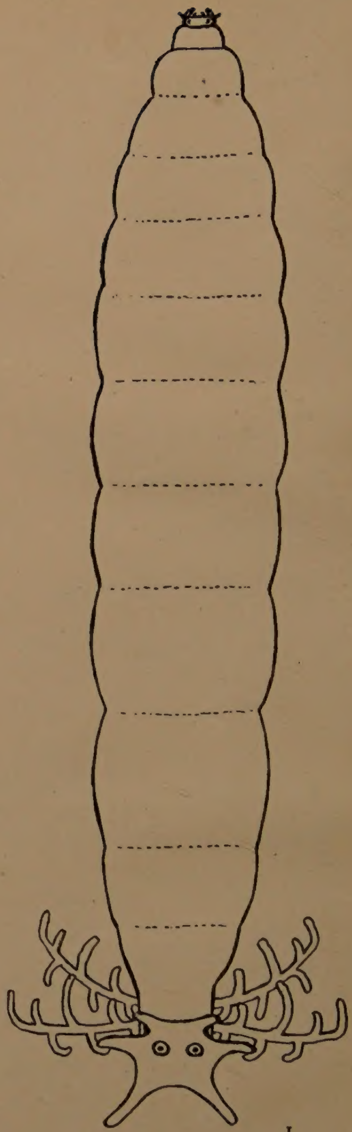

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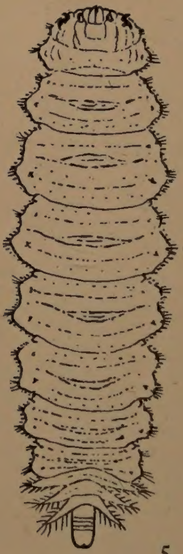

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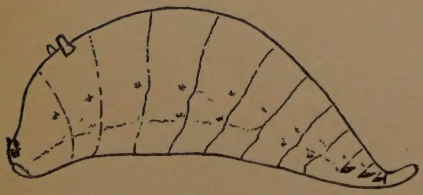

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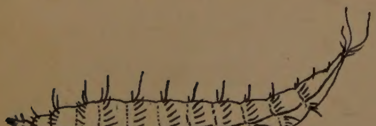

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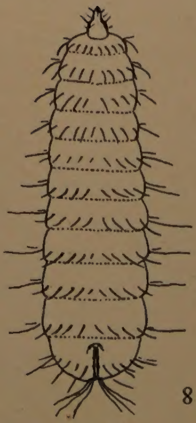

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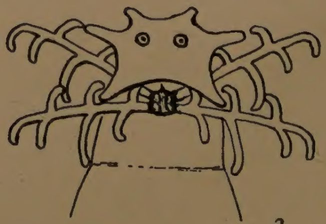

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JOHNSON: DIPTEROUS LARVAE

PSYCHE

NOTES ON SOME DIPTEROUS LARVAE.

BY CHARLES W. JOHNSON, BOSTON, MASS.

While collecting at Riverton, N. J., on June 10, 1900, I found in a spring, a large and very peculiar larva. It was placed in an aquarium and for three days was quite active and seemed to be doing nicely. Its large size and the time of the year were both favorable for bringing it to maturity, but on the morning of the fourth day it was dead. As the aquarium was well balanced, I can only account for its death by the change in temperature, as the weather was very warm at the time, and the spring from which it was taken quite cool, about 60°.

While it was living I had a good opportunity to observe its habits and make several sketches, from which the drawings accompanying this article were made. The larva, when extended, was about 45 mm. in length; yellowish white in color, translucent, the alimentary tract, etc., being plainly visible, as the larva moved by expanding and contracting its body. When extended to its full length the posterior portion was elevated almost vertically, and the two pairs of peculiarly ramified appendages extending from the anal prominence were expanded to their full size as shown on Plate I, figures 1 and 2. At other times they were more or less contracted. Figure 2 is made to show the posterior portion vertically extended, and showing the ventral surface. The respiratory disk or stigmatal area bears three pairs of marginal projections, the lower and lateral ones being much the larger; spiracular openings yellow, with a narrow margin of brown and a black central spot. Head yellowish, with a short black line above the base of the antennae; tips of the antennae and mandibles, reddish brown.

The specimen preserved in alcohol, but giving very little idea of its appearance when living, was shown at a meeting of the Feldman Collecting Social, held in June, 1900, and from its size was referred doubtfully to *Tipula abdominalis* (Entom. News, xi, p. 578. 1900). Since that time the larva of *T. abdominalis* has been described and figured by Professor James G. Needham (see "Aquatic Insects in the Adirondacks:" N. Y. State Museum, Bull. 47, p. 575, pl. 35, figs. 1, 2. Sept., 1901). This shows a very different larva—more closely related to that of *Tipula eluta* Loew, described and figured by Mr. C. A. Hart (Bull. Ill. State Lab. Nat. Hist., iv., p. 210, pl. viii., figs. 32, 33. 1895).

It is thus evident that this is not the larva of any of our larger species of *Tipula*, and another correspondingly large form has to be considered. I am, therefore, inclined to look upon this as probably the larva of *Longurio testaceus Loew.* This species is not at all common. I have only seen one from Fairmount Park, Philadelphia, collected by Mr. H. D. Coyle, and two taken by the writer at the Delaware Water Gap, July 12, 15, 1898, along Dunnfield Creek, a cool mountain stream flowing into the Delaware on the New Jersey side. It is to be hoped that this description and figure will lead to the positive identification of this interesting larva.

LIMNOBIA TRIOCELLATA Osten Sacken. Plate I, Figs. 3, 4.

The larva of this species was found in considerable numbers in fungus in the woods at Riverside, near Auburndale, Mass., August 21, 1904. They commenced pupating the following day, and the imagos appeared on the 30 and 31.

The larva (Fig. 3), is about 18 mm. in length, cylindrical and gradually tapering towards the ends; color, a translucent yellowish white; mouth parts dark brown. The finely roughened transverse lines at the margins of the segments aid in its locomotion. The larva when found is apparently enveloped in a mucus-like covering, and when disturbed moves very rapidly through the fungus in either direction.

The pupa (Fig. 4) is about 13 mm. in length; yellowish at first, the wings and legs becoming a dark brown with age; antennae curve above the eyes, and disappear beneath the wings; the legs lie parallel to each other on the ventral surface, the tarsal claws ending near the middle of the fourth segment of the abdomen.

ARCHYTAS HYSTRIX Fabr.

This species was bred from *Datana major* Grote, July 7, 1905, by Mr. A. C. Sampson of Sharon, Mass. I can find no previous record of its host.

XYLOTA PIGRA Fabr. Pl. I, Figs. 5, 6.

While searching beneath the bark of pine logs for the larva of *Xylophagus*. I found the larva of this species in considerable numbers. It frequented the wet bark near the ground where there was more or less fermentation of the sappy portions of the wood and bast. The larva (Fig. 5) is about 14 mm. in length, of a dirty yellow or brownish color, with ten or eleven ill defined, rugosely wrinkled segments, covered with short hairs, which are somewhat longer on the sides. The first segment is armed on each side with a pair of black spines, the posterior one curved backwards; above the spines are small brown papillae; the posterior portion bears on each side three large, hairy, spine-like processes, and terminates with a prominent, shiny brown respiratory tube, showing slight annulations on the middle.

The larvae were collected near Auburndale, Mass., March 26, 1905. They commenced pupating March 31, and continued to do so until April 3, the imagos appearing from April 12 to 15. On June 16, 1904, I captured the adults of this species at the same locality. The pupa (Fig. 6), is about 10 mm. in length; dark brown in color, the black spines and small papillae of the larva being still present, with an additional pair of larger papillae above; the posterior portion also has a similar appearance to the larva, retaining the lateral processes and respiratory tube. The imago emerges through the upper portion of the first two segments.

The larva of this species was also found under similar conditions near South Framingham, Mass , by Mr. A. P. Morse.

Figure 7 represents a larva found by Mr. Owen Bryant at Cohasset, during the latter part of September, among some "woolly" aphids on the wild lettuce *(Lactuca elongata).* The larva was very flat, about 7 mm. in length, slightly roughened, and of a dull yellowish color. It evidently belongs to the Syrphidae. I did not succeed in getting it to pupate.

ZABRACHIA POLITA Coquillett, Plate I, Figs. 8, 9.

Z. polita Coq., Aquatic Insects in the Adirondacks (N. Y. State Museum, Bull. 47, p. 585. 1901).

Associated with the larva of *Xylota pigra* (Fabr.) were a number of small larvae which proved to be this interesting little Stratiomyid, allied to the genus *Pachygaster.* The larva (Fig. 8) is about 5 mm. in length, somewhat flattened, of an obscure brownish color, shiny, with a transverse row of long hairs at or near the middle of each segment. The cephalic portion is narrow and of a reddish color; the posterior segment broadly rounded, with a narrow ventral opening and six long terminal hairs.

This larva cannot be properly classed as an aquatic insect, as the decayed bark in which the specimens were kept frequently became quite dry without any apparent injury, almost every specimen reaching maturity. Although not in water the larva has the same habit as those of *Odontomyia,* etc., of extending the posterior end of its body upward as shown in figure 9. The pupa is formed within the larval skin, with no apparent change, so that the date of pupation cannot be given. The imagos commenced to appear May 12, and continued to do so until June 20.

The adult emerges through a dorsal slit extending across the second, third and part of the fourth segments of the larval skin, the first segment being invariably removed in the process of emerging.

NORTH AMERICAN BEES OF THE GENERA ANDRENA AND MELITTA IN THE BRITISH MUSEUM.—I.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

When, in the summer of 1904, I visited the British Museum, one of my chief objects was to examine the types of the American species of *Andrena* described by F. Smith. These insects, described when comparatively little was known about American bees, had always been difficult to identify, and with a few exceptions the current identifications were open to more or less doubt. Some years ago, the Rev. F. D. Morice very kindly sent me a series of notes resulting from his examination of them, and these were published in the *Canadian Entomologist*, 1901; but further investigation was clearly desirable. I did not publish my notes on *Andrena* along with my other remarks on the British Museum bees (*Trans. Am. Ent. Soc.*, 1905), because it was intended to include them in a lengthy paper which Mr. Viereck expected to publish in 1905; but as this work (a review of all the known American *Andrenae*) is likely to be much delayed, I give them here.

Melitta americana (Smith).

Cilissa americana, Smith, ♀. Length 12 mm. or slightly over; facial foveæ apparently very broad, but ill-defined and not hairy; process of labrum low and broadly rounded; clypeus with a longitudinal median ridge, the upper part of which is narrow and grooved, while the lower part is very broad, and shining; rest of clypeus dull, with rather close punctures; mandibles broad at apex, with a short inner tooth; cheeks ordinary; mesothorax fairly shining, with quite close shallow punctures, which look as if caused by blows from a hammer; mesothorax and scutellum with a good deal of black hair, which, however, is not conspicuous, except perhaps at sides of scutellum; scutellum shining on disc, with definite punctures; postscutellum quite dull, with a curious subtesselate surface, and posteriorly with long hair; enclosure of metathorax triangular and ill-defined, slightly wrinkled at base; tegulæ with a conspicuous ferruginous spot; stigma yellowish-ferruginous, small and lanceolate; second submarginal cell not far from square, equally broad above and below, receiving the recurrent nervure at its middle; third submarginal cell very long, narrowed more than half to marginal; middle femora reddish, sharply keeled beneath; hind trochanters without any curled floccus; hair on outer face of hind tibiæ rather long and coarse, but not plumose; abdomen broad and dullish, with numerous distinct piliferous punctures, but not otherwise punctate; caudal fimbria dull black.

By the obliquely truncate apical joint of antennæ, and characters of legs, this is a veritable *Melitta* (=*Cilissa*); by the dark caudal fringe it is allied to *M. leporina*, but it is not that species. It was described vaguely from the "United States," but Mr. Lovell informs me that he has taken it at Waldoboro, Maine.

Andrena commoda (Smith).

♀. Expanse of wings about 22 mm.; facial foveæ quite broad, whitish; clypeus closely punctured, with a strong median ridge; tubercle on labrum large and quite broadly rounded, not nearly so pointed as Morice's account suggested; eye not separated from fovea by more than the usual narrow line; mesothorax minutely roughened, with small shallow punctures; mesothoracic area not distinctly defined, only minutely plicate basally; tibial scopa fulvo-ferruginous, not plumose; basal joint of hind tarsi broad, red, with ferruginous hair on inner side; abdomen not hairy as in *sayi*, having only piliferous punctures (but these very distinct), and not fasciate; fimbria a fine orange-fulvous. I noted that it suggested *A. corni*, Rob., and later Mr. Viereck sent me a specimen of *corni* to compare, and I found no difference.

Andrena integra, Smith.

♀. In Robertson's tables this runs to 11, and then runs out, because of unbanded abdomen and eye not widely separated from fovea. Compared with a species from Pennsylvania sent by Mr. Viereck, and supposed to be *integra*, the type was found to be a smaller and very different species, without abdominal hair-bands, and with the fimbria strong light ferruginous. It has strongly-marked, yellowish-white, *narrow* facial foveæ, adjacent to the eyes; clypeus microscopically tessellate, with scattered and shallow but distinct punctures; scutellum very shiny, its disc wholly impunctate; wings yellowish, stigma dark ferruginous.

Upon learning that the supposed *integra* was not that species, Mr. Viereck sent *A. lineata*, Prov., suggesting that this was the real *integra*. Careful comparisons showed that they were identical.

Andrena subtilis, Smith.

♀. Vancouver I. (*Lyall*). Supposed *subtilis*, sent by Mr. Viereck, was a much smaller and very different species. The real *subtilis* is a large, handsome species, with strongly fulvous hair on thorax; abdomen dark green, without any distinct bands; fimbria fulvous; stigma narrow, dark red-brown; process of labrum pointed; fovea broad, pale red, adjacent to eye. Size about equal to *vicina*. Later, Mr. Viereck sent for comparison a specimen of *A. seminigra*, Vier., which proved to be exactly the same.

Andrena algida, Smith.

♀. Hudson's Bay. Mr. Viereck sent a Philadelphia specimen of what had been taken for *algida* in this country; but the real *algida* proved to be quite a different species, with the following distinctive characters: larger; facial foveæ short, strongly reddish, seen from above occupying only about half distance between eye and antenna; process of labrum broadly rounded; third antennal joint longer; wings not yellowish, stigma and nervures duller and darker; abdomen more hairy, the hair of the bands longer and not so dense; segments 1 and 2, viewed laterally, with very conspicuous suberect hairs on hind margin; venter of abdomen dark reddish-brown; anal fimbria pale sooty; hind tibiæ, as well as their tarsi, dark reddish.

In Robertson's table, *algida* runs to *A. arabis*, Rob.; Mr. Viereck sent me *arabis* to compare, and I found them closely allied, but apparently distinct. *A arabis* has hair of abdomen yellowish, *algida* has it dull white, with the fimbria pale grey; the whole pubescence of *algida* is greyish, contrasting with the strongly ochreous of *arabis*; *arabis* has the flagellum beneath, and the claw-joints, very red, which is not the case in *algida*; the clypeus of *arabis* seems to have rather larger punctures than those of *algida*, though they are alike in character; in the dry state the eyes of *algida* are grey, of *arabis* black; in *arabis* the basal joint of hind tarsi within is darkened, in *algida* it is entirely pallid, with a pale ochreous tint.

Andrena fragilis, Smith.

Expanse of wings just over 14 mm. Runs to *platyparia* in Robertson's tables. Compared with *platyparia*, I found that *fragilis* had the hind tarsi and hair at apex of abdomen redder, but there was no essential difference.

Andrena placida, Smith.

♀. Length about 10½ mm. Fovea broad, seen from above pale reddish; process of labrum remarkably long and narrow; clypeus convex, microscopically tessellate, with quite widely separated punctures; disc of mesothorax dullish, with minute, well-separated punctures; metathorax truncate, the enclosure rugose-wrinkled, very ill-defined; hair of hind tibiæ plumose, at least in part; stigma ferruginous, quite large; abdomen with apparently a very faintly purplish tint, and with only piliferous punctures, and these very few and minute; fimbria dark purplish-chocolate; depressed hind margins of abdominal segments reddened; pygidial plate with a grooved V. This is not *A. cressoni.*

Andrena sodalis, Smith.

♀. Oaxaca. Ordinary-looking species, easily known by hind tibiæ and basal two-thirds (at least) of basal joint of hind tarsi clear light reddish-fulvous, strongly contrasting with the very dark brown hind femora, and apical part of basal joint of tarsus, as well as small joints of tarsus. The anterior and middle legs are also wholly very dark brown; the tibial scopa is strongly plumose. Facial foveæ fairly broad, their pubescence (seen from above) very dark seal brown; clypeus with quite a broad median impunctate band or area; abdomen practically impunctate.

A second specimen has only about half the basal joint of hind tarsi fulvous, junction of the two colors very oblique. Fimbria light brown, with a greyish tinge.

Andrena simplex, Smith.

♀. Length less than 10 mm.; clypeus minutely roughened, with scattered, shallow, piliferous punctures; labrum with reddish hair, contrasting with the dull white hair of clypeus; third antennal joint longer than 4+5; disc of mesothorax shining, with small, widely-separated punctures; fovea short, not widely separated from eye; area of metathorax merely roughened, very ill-defined; metathorax with a *concave* truncation; tegulæ dark red; stigma small, light reddish with a dark margin; third submarginal cell very broad above; first three segments of abdomen dark reddish; hair on outer face of hind tibiæ plumose; basal joint of middle tarsi quite broad.

Andrena hilaris, Smith.

Mr. Viereck sent one from Clementon, N. J. I found Smith's type identical, except that it had dark red legs.

Andrena auricoma, Smith.

Mr. Viereck sent a Corvallis, Oregon, example of this remarkable species, and it was the same as the type. The type has the first recurrent nervure joining submarginal cell some distance basad of the middle.

Andrena vicina, Smith.

A specimen from Philadelphia, Pa. (*Viereck*), of the species recognized as *vicina* in America, agreed with Smith's type.

Andrena nivalis, Smith.

A Milwaukee, Wis., specimen, sent as "*nivalis ?*" by Mr. Viereck, proved to be Smith's species. In the type the longitudinal ridge on the clypeus was more prominent than in the Wisconsin specimen.

Andrena cærulea, Smith.

Compared with *Ptilandrena crypta*, Viereck, this was found to be very closely allied; they have just the same color and sculpture, and the same reddish, narrow, short facial fovea. *A. cærulea* is larger, and has the scopa of hind tibiæ dark brownish-grey, a good deal of long, erect, black hair on face, and some black hair at sides of mesothorax.

Andrena nubecula, Smith.

Compared with a Milwaukee specimen, and found the same; the species is well known. The type has lighter tegulæ than the Wisconsin example.

Andrena fimbriata, Smith.

Expanse of wings 20 mm. A specimen sent by Mr. Vierick is correctly named; the type is rather smaller, and has the first recurrent nervure joining second submarginal cell nearer its end. *A. fimbriata* is a homonym, and Dalla Torre changed it to *americana;* but Mr. Viereck finds that it is *hirticincta*, Provancher, and this name has priority.

Andrena fulvipennis, Smith.

I could not find a specimen of this in the collection.

Andrena flavoclypeata, Smith.

♂. This is generally understood to be *bipunctata*, Cresson, and the type runs to that species in Robertson's tables. Compared with a specimen of *bipunctata*, the type of *flavoclypeata* differs by being a little smaller, with the flagellum light reddish beneath except at base. The clypeus is a sort of pale orange, instead of a clear lemon yellow, but this may be due to cyanide. The tarsi are decidedly reddish.

Andrena perplexa, Smith.

Compared with a Corvallis, Oregon, example, sent by Mr. Viereck, the type differed by the bright orange-red hair on scutellum, and pubescence in general brighter; but they appeared to be the same species.

Andrena candida, Smith.

The type (Vancouver I., *Dr. Lyall*) was compared with a Corvallis, Oregon, specimen sent by Mr. Viereck, and found to be apparently the same species, but with rather strong varietal differences: —

Type.	*Corvallis specimen.*
Stigma dark red.	Stigma pale amber.
Abdomen strongly blue.	Abdomen greenish.
Facial foveæ dark chocolate color, very handsome.	Facial foveæ less conspicuous

MOUTH PARTS OF MOSQUITO LARVAE AS INDICATIVE OF HABITS.

BY EVELYN G. MITCHELL, WASHINGTON, D. C.

The larvae of the Culicidae follow the usual rule that a difference in the structure of the mouth parts is correlated with a corresponding difference in their food habits. This fact first forced itself upon the writer's attention when studying the habits of the Louisiana species, while making drawings and dissections for Dr. J. W. Dupree, and was later confirmed when making dissections and drawings of larvae of additional species for Dr. Howard's forthcoming monograph of this family.

These larvae fall into two categories, viz.: 1. Insectivorous, which, like *Megarhinus* and *Psorophora*, normally prey upon small aquatic larvae; and 2. Non-sectivorous, like *Culex*, which feed on Euglena and other protozoa, bacteria and vegetable matter; while between these groups are two others, somewhat intermediate, viz.: the *Uranotaenia* and *Anopheles* groups. That the differences in habits are correlated with marked differences in the structure of the mouth parts will be seen by the following critical comparison of the types of these four groups:

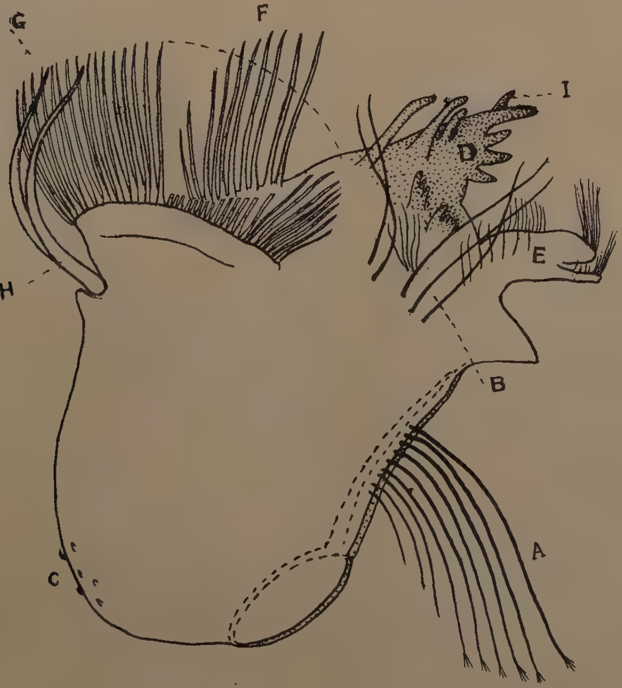

Fig 1. Mandible of *C. taeniorhynchus*.

I. NON-INSECTIVOROUS	II. URANOTAENIA.	III. ANOPHELES.	IV. INSECTIVOROUS.
MOUTH BRUSHES. Hairs slender, very numerous, slightly pectinate or simple, projecting forward; adapted for making a current toward the mouth.	Same as I.	Same as I.	Stout, heavy, chitinised hairs, serrate on distal part; held at right angles to head or folded under. Adapted for seizing.
MANDIBLES. (See Fig. 1.) *Biting Part.* (D.) Comprises 1-10 of whole mandible. Anterior tooth heavy, rather blunt, not sharply differentiated from the three following teeth (of which the third is largest and longest), which do not recede sharply; two teeth, usually sharp and slender, at base of primary tooth. Some short, blunt teeth on ectal side of mandible below main group and not projecting so far. Arrangement primarily for crushing.	Same as I, except that the anterior tooth is especially heavy and blunt, and the teeth at base of primary tooth are heavy and blunt.	Heavily chitinised; about 1-6 of whole bulk. Anterior tooth sharp, conspicious, not sharply differentiated from the three smaller teeth which are placed so that their tips form a sharply receding line; two rather blunt teeth atop of the primary tooth at its base; a bunch of many short, sharp spines and small teeth below last well developed tooth. Arrangement for tearing or crushing.	Very heavily chitinised, forming about one-fourth of bulk. Anterior tooth (especially in *Psorophora*) very long, pointed, well separated from rest, heavy; other teeth sharp. Arrangement for tearing. Much more irregular than in the foregoing forms. Stout accessory spine on side of base of primary tooth, ectal aspect, in *Psorophora*.
Articulate serrate spine. (I.) Sometimes deeply, sometimes bluntly serrate, narrow or broad, long or short, but never so wide as biting part, on ental side and projecting beyond biting part; four to twenty serrate-plumose, slender movable spines below it. Movement evidently like a chopper.	Of one very large tooth, serrate at base and differentiated from the four following sharp teeth; whole arrangement as large, though not so heavy, as the biting part. No small articulate spines.	A heavy, wide, flat, irregularly serrate spine; below it are two articulate, flat, narrow spines with hairs in the serrations.	Not present.
Lateral Comb. (G.) Many, never very heavy, elongate, somewhat curved, triangular	The three uppermost spines heavy and strongly chitinised; base	The three uppermost spines not conspiciously heavier than the rest.	Long, curved, heavy, immovable spines, especially heavy and finely

I.	II.	III.	IV.
plates, set with flat sides parallel on a chitinised ridge; somewhat movable in a line parallel to base; base coming in a curve from a point half way between the lateral and mesal margins to the ectal end of the cephalic (or top) margin with which it forms an acute angle.	heavy, not forming so acute an angle as in I, but, like III, at not so great an angle with base of primary tooth, nor so far forward as in IV.	Base as in II.	set in *Psorophora*, few as compared with other forms (especially in *Psorophora*), their base forming almost a right angle with top of mandible, and pushed forward almost to base of primary tooth.
Marginal Comb. (F.) Either fifteen to twenty, more or less, sigmoid, immovable spines, with the two or three nearest base of lateral comb more or less plumose; or a row of papillae bearing single, feathered hairs or very short hairs (in the latter case the papillae are moved over the top of the mandible onto the ental aspect).	None	Two fringed plates near base of biting part and four or five long fringed hairs set at a distance from these and against the upper end of the base of the lateral comb.	None.
Projection below last tooth. (E.) About size of biting part and resembling a turtle's head with open jaw; a tuft of small hairs on top of "head," one on the upper line of "lower jaw," a line, more or less, along back and side of "neck." A small, heavily chitinised projection below.	A huge, shapless projection about one-fourth size of whole mandible, bearing on the lateral margin a row of short, hooked hairs and two bunches of slightly longer hairs on the side, joined with projection below it.	A distinct, rounded projection, having on top a small papilla with a few minute hairs. No projection below.	Projection below last teeth aborted into a few irregular projections in *Psorophora;* joined with the next lower projection and larger in *Megarhinus*, having a projection below it in *Psorophora*.
Simple articulate spines. (H.) On latero-cephalic angle below upper end of base of lateral comb; two slender, crescent-shaped.	Four large, flat, sharp spines, the outer ones about one-third longer than the inner, which are a little fringed, taper	Four large, flat, sharp spines, dilated at base; outer two smooth, rather sharply bent near base; inner two sigmoid, more	A single, heavy, sharp curved spine in *Psorophora;* two rather slender spines with three or four plumules in *Megar-*

I.	II.	III.	IV.
	to base and are not sigmoid.	or less fringed; all of about an equal length.	*binus*.
Hairs between articulate simple spines and upper end of base of lateral comb, usually not present but sometimes 5-6, rarely a pair so well developed that they might almost be considered spines.	A large number of hairs about as long as the serrate pair of articulate spines.	Eight or 9 short, slender hairs.	Nine hairs.
Hairs. Group A. (See Fig. 1.) 4-25 hairs, some of which are generally tufted at ends, occasionally a few are slightly plumose.	Two or 3 very large flat setae, serrate; the teeth may or may not end in small hairs.	About 22 hairs, those toward base of mandible split into 3 or 4 shreds at end.	About 25 long hairs in *Megarhinus*; 8-10 short hairs in *Psorophora*.
Group B. (See Fig. 1.) Two to 10 heavy hairs, occasionally split, in a scattered line between *A* group and lower end of base of lateral comb.	Eight to 16 graded hairs, somewhat split at tips, closely set in a group contiguous to *A*.	Four to five slender, short hairs well above *A*, near lower end of base of lateral comb.	Wanting.
Group C. (See Fig. 1.) Two to 12 small spines (except in Deinocerites, which see in summary) on the lower part of the lateral aspect.	Two to 5 small spines.	Two slim, fringed hairs on papillae with 8-9 broad, plumose, long hairs in a transverse row below.	Very few, minute, broad spines.
Maxilla. (Fig. 2) Cone-shaped, more or less flattened, always proportionately narrower than in Uranotenia (II).	A sort of flattened, irregular cone.	A parallelogram (approximately about 2 x 1).	Trapezoid, the cephalic aspect the longest in *Psorophora*; nearly square with a deep emargination in middle

I.	II.	III.	IV.
			of cephalic edge in *Megarhinus*.
Palpus.			
Not large, distinct, cylindrical, somewhat constricted about middle, top rounded irregularly, 4-5 short, blunt spines, reaches ¼-½ to top.	Not large, distinct, cylindrical, top flat, with 4 very large and 2 small, blunt spines (2 of the large spines sharp, 2 blunt); does not reach over ⅓ to top of cone.	Top about even with top of maxilla, very slightly rounded, with 4 large spines and 2 or 3 flat, sub-triangular plates articulated by the apex of the triangle; with a deep sinus between its upper part and the body of the maxilla; the lower part rounded and projecting below base of body of maxilla; upper part a truncate cone. A large, tree-like hair from a papilla on lateral aspect.	Projects above body of maxilla; bluntly rounded at apex in *Megarhinus*; truncatein *Psorophora*; with four stubby spines; springing direct from top of maxilla in *Psorophora*, from the base in *Megarhinus*, being much larger therefore in the latter; cylindrical.
Strip of chitin.			
Narrow, very heavy, from top of cone to base, slightly curving from palpus as it approaches base and continuing into the heavy rim of chitin at base.	About the same as in I.	None.	None.
Spines.			
Two, stout, more or less blunt, from papillae next to above chitinous strip on same side as palpus and about on a level with its top; their points usually reaching across strip of chitin.	Present, very large, slightly removed from strip.	Very short, on the farther side from palpus of an imaginary line parallel to palpus and dividing body of maxilla in half, and on the upper half of the side.	In *Megarhinus* the spines are near top on the side of the emargination nearest the palpus; in *Psorophora* they are near the top on the third of the body of the maxilla farthest from the pulpus.

I.	II.	III.	IV.
Tuft A. (See Fig. 2.) A large tuft of long or short movable hairs at apex, often a line extending down the chitinous strip toward the double spines.	Of immense, flat setae serrate on one side.	A row of papillae, bearing several short hairs each, extending along top of body of maxilla from end nearest palpus about half way; a row of erect, hooked hairs for about the same distance, continued into a thick mass of hairs curling down across the top; a bunch of short spines at end farthest from palpus.	In *Psorophora* a row of short, flat, triangular spines along the apex from base of pulpus, curling over and continued in a patch half down the side on the half away from the pulpus, at the third farthest from the pulpus these spines are very large, hooked and in 3 rows. In *Megarhinus* a large patch of straight, short spines and one long, slender spine on side of emargination nearest pulpus; a double row of large, hooked spines on farthest elevation, continued into a graded row of straight spines ⅓ down mesal margin, and 1 hair-like spine.
Long patch of short hairs. Some slender, some spine-like or thickened and split, on side of chitin strip farthest from pulpus. Usually a few hairs on side next pulpus.	Same, but the hairs not thickened but closely set.	Many short, curved hairs in groups on upper ⅓ next pulpus, set thickly on upper middle ⅓ and upper and lower ⅓ farthest from pulpus.	Wanting.
Labial Plate. Nine to 33 teeth; in general tending to 15-23 rather fine, evenly graded teeth except in the long breathing tubed species where the teeth show a tendency to irregularity difficult to describe but easy to see.	Coarse, bluntly rounded teeth, 11 in number. General shape of plate ellipsoidal, a regular outline.	Coarse, much separated, rather sharp, irregular teeth, 9. Not a regular curve.	Teeth tend to coarseness and to have center and end teeth largest in *Psorophora*.

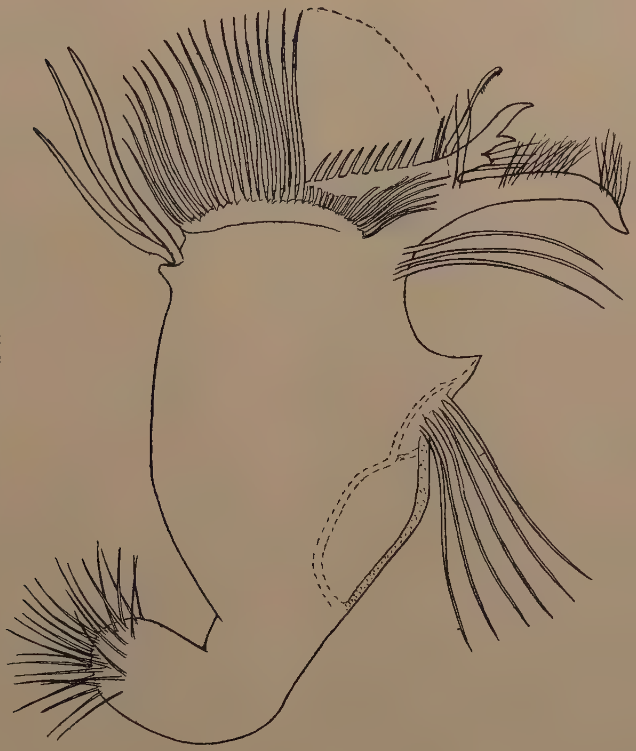

Fig. 2. Maxilla of *C. salinarius.*

As the above comparative scheme shows, in insectivorous forms the principal appendages of the mandibles and maxillae are sharp, heavy and fitted for tearing; or stiff, spiny, immovable, and adapted for holding the struggling prey. The corresponding appendages in the non-insectivorous forms, whose food is microscopic, are more blunt and better adapted for crushing; or are slender, more or less movable, and fitted (as the *A* tuft of the maxilla) for aiding the mouth brushes to draw food into the mouth; or (as the smaller hairs of the maxilla) for a sieve. The plates of the lateral comb on the mandible are movable in the plane of the base, and, so the writer thinks, help to direct food toward the crushing portion, the other comb acting as a sieve and the remaining appendages being sieves or tactile organs.

Anopheles and *Uranotaenia* seem to exactly correspond with neither of the foregoing groups. *Psorophora* we know will prey on larvae of other species and even turn cannibal if hard pressed. *Megarhinus* will do the same. *Psorophora*, however, can exist, temporarily if necessary, on a diet of *Euglena*, though it does not thrive on this, as Dr. Dupree proved when the writer was with him. *Anopheles* will bite each other viciously, tearing off the hairs so frequently that perfect specimens of the larvae are to be obtained only by isolation; will devour skins, occasionally kill other larvae and always eat any which die. *Uranotaenia* is supposed to have the same habits as *Anopheles*, save that, whereas *Anopheles* skims the surface, *Uranotaenia* feeds just below. From the shape of the mouth parts, however, the writer would judge the latter to be distinctive in its method, a vegetarian and also feeding on minute crustacea and the like.

In the non-insectivorous groups are two distinct types of mandible and maxilla. The facts on hand suggest that these are associated with two types of breathing tubes and antennae, as well as with different habits of feeding. The author hopes to make further observations when opportunity offers, not having hitherto paid special attention to this point.

The group with long breathing tubes (*M. atratus*, *C. pipiens*, *C. territans*, *C. C. restuans*, *C. salinarius*), feed with the tubes almost continually at the surface, sailing about by the movement of their mouth-brushes, and leaving the surface only when disturbed. Their food evidently floats freely, and is drawn in by the currents set up by the brushes. In these forms the antennae have very large and plumose tufts; the marginal comb on the mandible is reduced to papillae bearing a few hairs and moved over the top somewhat onto the opposite side from the lateral comb. The maxillae are of a pointed, sub-conical form, with the terminal hairs freely movable and very long, many of them as long as, or longer than, the body of the maxilla, with several long-plumose hairs in the tuft, which is mostly composed of single hairs. The plumose hairs are probably sensory, while the function of the simple hairs is probably only to brush in food.

C. discolor forms an apparent exception, having this type of maxilla and mandible, but when one considers that, although he feeds at the bottom, he lies on his back most of the time, and feeds on floating matter, his not feeding near the surface makes no great difference.

C. jamaicencis, *J. musica*, and *J. varipes* also belong to this type, though the latter two can stay at the bottom a long time if disturbed.

The bottom feeders, as far as known, have straight, stubby antennae, generally bare of spines, with one hair or a very few simple hairs in the tuft. The mandible has the marginal comb well developed, the maxilla is a flattened cone, the terminal tuft of stiff, straight hairs, which are rather short, is evidently for use in brushing over the debris at the bottom, where the very long, slender hairs would be a disadvantage. *C. dupreei*, with its very short antennae, and its bottom feeding habits, is a very good example. *C. triseriatus* lives in hollow trees, and feeds at the bottom of the hollow; the antennae, mandible and maxilla are all typical of this habit. To have such a type of mouth parts the larvae need not necessarily be bottom feeders; they may brush over the sides of a tank or floating or half-submerged objects, grasses, spirogyra, etc. There are maxillae which seem transitional, though there are only the two types of mandibles; and there are in some maxillae peculiar developments of the lateral hairs, which are probly related to some peculiar habit of feeding, or character of food.

Among the non-insectivorous larvae is one, *Deinocerites cancer*, that so distinctly and strikingly, in several respects, departs from the ordinary type of larvae as, so the writer believes, to justify its being placed in a new sub-family, DEINOCERITINAE. The head is sub-circular and is characterized by an angular projection of the chitin caudad of the base of each antenna. This lateral angle forms a groove, running on the ventral side of the head, in which groove the basal portion of the lateral aspect of the mandible moves in and out, so as to be visible from above, a thing which, so far as the writer knows, exists in no other culicid larva. The anal gills are entirely absent.

The maxilla affords no striking departure from the type, it being in general that of a larva feeding on floating objects.

The labial plate is different from others in that the teeth, instead of being broad at the base and coming gradually to a distinctly narrow point (with but few exceptions), are but little narrowed until they abruptly point off, are very long for their width and, especially, are all separated from each other by a space of more than their width, while the two basal are very much longer than any but the central (which is about twice the length of the rest), and are set caudad from the base of the next by about their own length.

The mandible is like no other (see fig. 3). The biting part is three, weak teeth, not heavily chitinised (the whole larva is almost transparent), set in a decidedly receding row. Normally, the non-insectivorous larvae have four teeth, not receding very much. The projection just below the teeth, instead of being about twice as long as wide, and having an "under jaw," is fully six times as long as wide, the tip pointed and bent down for about one-fourth the length. The marginal comb is nine short, sharp, stright spines. The chopper-like part is a sort of narrow hook, finely serrate at the distal end. There is a third articulate spine, shorter than the others, between the usual two, an odd number in this place being very unusual. But the distinguishing feature is the caudal portion of the lateral aspect. In other mandibles, so far as the writer can ascertain, this part forms an even, continuous curve with the rest of the mandible body and bears a very few minute spines, or (as in *Anopheles*), a row of fringed hairs. In *D. cancer* this portion of the mandible is produced, and in shape is like the thumb held on a plane with the hand and flexed at the second joint. The part flexed in the man-

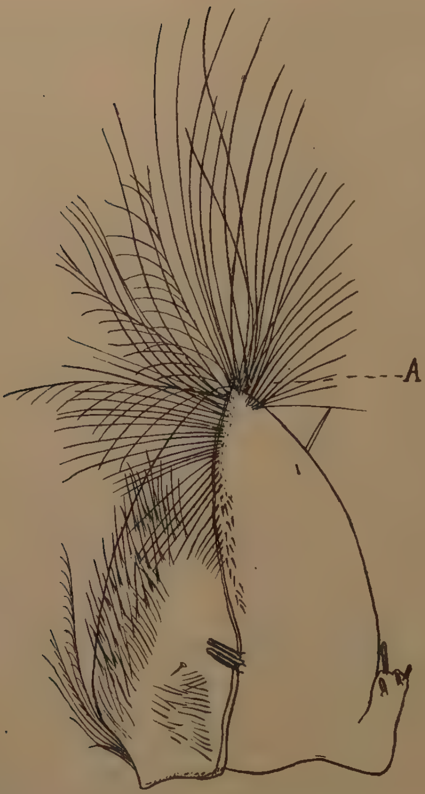

Fig. 3. Mandible of *Deinocerites cancer.*

dible seems to be rather soft as, although no suture can be seen, the projection is capable of a slight flexion and extension. The projection works in the trough formed by the angle of the head. Instead of the usual minute spines at this point there are about twenty-five long, slender spines placed in a group with their bases well separated. They are apparently somewhat movable. The function is difficult to imagine.

The adult is distinguished from all others by the unusually long antennae in both sexes; according to Mr. Coquillett, the second antennal joint is over fourteen times as long as wide, whereas in other forms of culicidae it is less than eight times as long as wide.

It will be noted in the forgoing comparative study that *Psorophora* falls into the same category with *Megarhinus*, to which it is much more nearly related both in anatomy and habits than to *Culex*, in the same sub-family with which it is at present classed. The larva, however, differs from *Megarhinus* in several important respects, not only in mouth parts but also in regard to external characters. In *Megharinus* the antennae are situated far forward, and the eyes are near the middle of the side of the head; in *Psorophora* the antennae are near the middle of the side of the head, and the eyes are near the caudal angle. On the thorax of *Megarhinus* are a number of stiff, coarse spines with spinules; no such spines occur in *Psorophora*. In *Megarhinus* the hairs of the abdomen are on large, heavily chitinised papillae, which is not the case in *Psorophora*. *Megarhinus* has the comb of the eighth segment represented by a chitinised plate from which spring two bristles and three minute tufts; the comb is present in *Psorophora*. The hairs of the ninth segment brush in *Megarhinus* are branched, not in tufts; in *Psorophora* they are simple and in tufts. The breathing tube in *Megarhinus* is without a pecten; *Psorophora* has a large pecten.

The adult *Megarhinus* has a strongly decurved proboscis, while in *Psorophora* it is straight. The depressed scales of the head and body in *Megarhinus* are much wider than in *Psorophora*; moreover, in *Megarhinus* the scales of the legs are never erect as in *Psorophora*. Therefore *Psorophora* can neither be placed in the same sub-family with *Megarhinus* nor with *Culex*, but should constitute a distinct sub-family, *Psorophorinae*.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXIV.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Cymatophora matilda Dyar.

Egg. Ellipitical, evenly rounded, strongly flattened dorso-ventrally but no flat areas, scarcely any truncation or depression, rounded disk-like; surface uniformly covered with beautifully waved quadragonal or pentagonal reticulations, gently raised, the surface over all very minutely granular shagreened. Dark olviaceous green; size .7 x .5 x .3 mm Laid in a flat mass.

Stage I. Head rounded, scarcely bilobed, free; yellowish luteous, brown around the edge of head cap and forming a shade by the six, seed-like, black ocelli. Body small, moderate, not elongate, rapidly looping; luteous yellow, dorsum broadly shaded in sordid olivaceous with illy defined edges, not quite reaching the ends. Tubercles minute, concolorous, except on the sides of the thorax where they are brownish. Setae very fine, moderately long, minutely glandular tipped.

Stage II. Head rounded bilobed, free, pale yellowish, eye black; width .5 mm. Body moderate, not elongate, whitish green; a broad, dorsal purple black band from joint 2 to before the anal plate, tubercles and setae invisible, tubercles concolorous, setae very short, black; no shields.

Stage III. Head strongly bilobed, subcordate, dull luteous whitish, ocelli black; width .75 mm. Body rather short and stout, held flat to the leaf, green, annulate finely; a broad brown dorsal stripe on joints 2 to 13. Feet normal, green. Setae short, black; tubercles concolorous with body, invisible; shields undifferentiated.

Stage IV. Head rounded bilobed, vertical and clypeal sutures depressed, mouth short and rounded, yellowish green, not shining; width 1.2 mm. Body short, stout, segments hardly longer than wide, smooth, pale green, not very opaque yellowish. A broad, diffuse brown dorsal stripe, obsolete at the ends, especially anterioly. A pair of stout, short anal prongs; feet green; no shields; tubercles and setae obsolete, the setae very short and dark.

The larvae ate aspen, but did not flourish, all dying in stage iv. I think, however, that they had reached the last stage. Eggs obtained at Kaslo, British Columbia.

RECENT ENTOMOLOGICAL LITERATURE

ILLUSTRATIONS OF DIURNAL LEPIDOPTERA WITH DESCRIPTIONS: by Andrew Gray Weeks, Jr. The University Press, Cambridge, 1905.

This volume is perhaps the most important addition to the literature of South American Lepidoptera of recent years. Beginning with a handsome steel engraving of Dr. Samuel H. Scudder, there follow descriptions of 81 hitherto undescribed or figured species of Diurnals collected in Bolivia in 1898-9 by Mr. Wm. J. Gerhard who headed an expedition to this unexplored region, the expense of which was borne by the author.

About 20 pages are devoted to an interesting account of this trip, illustrated by numerous half-tone plates of scenes in that far-off country.

Too much praise cannot be bestowed upon the 45 lithographic plates of the butterflies described. Nothing finer has been produced and it would seem that perfection in this line had at last been reached. The original water-color sketches were by J. Henry Blake, the well-known artist. Both the upper and under surfaces are shown and for minuteness of detail and faithfulness of reproduction the figures are all that can be desired.

Mr. Weeks deserves great credit for giving to the world the result of his labors in such a beautiful volume and it is a pity that all otherscan not follow his example by publishing plates with new descriptions.

H. H. N.

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Asterisks indicate descriptions of new species of American insects or new genera.

1. Proceedings, Academy of Natural Sciences, Philadelphia.
3. The American Naturalist, Boston.
4. The Canadian Entomologist, London, Ont.
5. Entomological News, Philadelphia.
6. Journal of the N. Y. Entomological Society.
7c. Circulars of Bureau of Entomology, Washington, D. C.
10. Nature, London.
14. Proceedings, Zoological Society of London.
22. Zoologischer Anzeiger, Leipzig.
35. Annales, Société Entomologique de Belgique, Brussels.
38. Wiener Entomologische Zeitung.
50. Proceedings, U. S. National Museum, Washington, D. C.
58. Revista Chilena de Historia Natural, Valparaiso.
68. Science, New York City.
89. Zoologische Jahrbücher, Jena.
97. Zeitschrift für wissenschaftliche Zoologie, Leipzig.
112. Bulletin, N. Y. State Museum, Albany.
123. Bulletin, Wisconsin Natural History Society, Milwaukee.
140. Biological Bulletin, Woods Hole, Mass.
141. The Ohio Naturalist, Columbus.
142. Invertebrata Pacifica, Havana.
148. Bulletin, American Museum of Natural History, N. Y. City.
156. Kansas University Science Bulletin, Lawrence, Kansas.
160. Memoirs, Carnegie Institution, Washington, D. C.
165. Science Bulletin, Museum of Brooklyn Institute, N. Y. City.
166. Annals of the Carnegie Museum, Pittsburg.
167. Redia, Florence.
176. Proceedings, Biological Society of Washington, D. C.
185. Zeitschrift fur systematische Hymenopterologie und Dipterologie, Teschendorf.
200. Bulletin, University of Texas, Austin, Tex.
201. Das Tierreich, F. E. Schulze, ed., Berlin.
202. Berichte der oberhessischen Gesellschaft fur Natur- und Heilkunde, Giessen.
203. Occasional Papers, Boston Society of Natural History.
204. Jenaische Zeitschrift für Naturwissenchaft, Jena
205. Circulars of the State Crop Pest Commission of Louisiana.
206. Bulletin, Georgia State Board of Entomology, Atlanta.

THE GENERAL SUBJECT.

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ECONOMIC ENTOMOLOGY.

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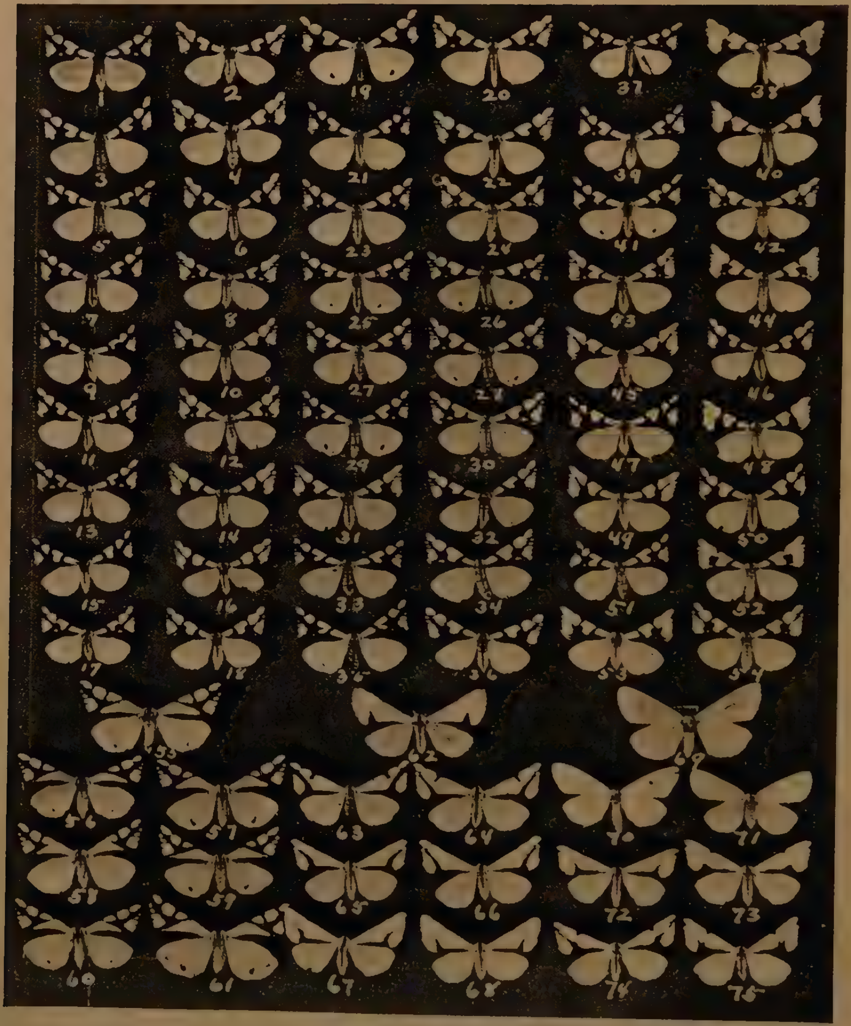
See also Heindel, under The General Subject.



FOSTER: HAPLOAS.

PSYCHE

FURTHER BREEDING EXPERIMENTS WITH HAPLOAS

BY F. H. FOSTER, CLAREMONT, N. H.

In the Entomological News for March, 1901, the writer gave some account of breeding experiments with Haploas. Experiments were continued during the four following seasons with a view to determining the limits of variation in the race of *Haploa confusa* occurring near Claremont and to working out more thoroughly the life histories of the other forms of the genus and their mutual relations. Efforts to breed successive generations from the same stock have been but partly successful owing to the difficulty of carrying the larvae in sufficient numbers through the hibernation.

Haploa confusa

From moths bred from wild larvae taken at Claremont in May, 1901, three successful pairings were obtained, viz:

Pair No. 1. Pl. II, Fig. 1 and Fig. 2 parents.
24 ♂—14 ♀ (See Pl. II, Figs. 3 to 18 for selected series of progeny)

Pair No. 2. Pl. II, Fig. 19 and Fig. 20 parents.
45 ♂—16 ♀ (See Pl. II, Figs. 21 to 36 for selected series of progeny)

Pair No. 3. Pl.II, Fig. 37 and Fig. 38 parents.
20 ♂—16 ♀ (See Pl. II, Figs. 39 to 54 for selected series of progeny)

A new supply of larvae was obtained in 1903 and three successful pairings were obtained from which were reared

from Pair No. 1 13 ♂ 6 ♀
" " No. 2 11 ♂ 4 ♀
" " No. 3 10 ♂ 8 ♀

These 1902 broods present no character materially different from the three 1901 series illustrated on plate.

Examination of the several hundred moths reared from our local race warrants the following conclusions.

1. The *confusa* type like figs. 1 and 2, Pl. 1 is the dominate form in this locality
2. While in any given brood the progeny vary considerably among themselves, striking departures from typical *confusa* are very infrequent.
3. The greatest divergence is in disappearance in occasional specimens of the brown cross-bands on primaries, this tendency being stronger in the females.
4. Some degree of sexual dimorphism exists, the males tending to show a greater extent of brown and the females a greater extent of white.
5. Occasional specimens occur conforming closely to Boisduval's type of *lecontei*. (Compare Pl. II, Figs. 45 and 49 with figure of type here reproduced.)

In the broods above referred to no instance of yellow in the ground color of the wings occurred, from which I conclude that the brood illustrated in Mar. 1901 Ent. News, which contained both yellow winged and white winged forms, contained a mixture of *clymene* blood due to some antecedent crossing. That such crossing sometimes occurs admits of little doubt. Strecker has reported taking *clymene* and *lecontei* in coitu from which resulted progeny like *lecontei* with yellow ground color. (See Proc. Davenport Academy of Nat Sci. V. II p. 275) and several aberrant individuals reared from wild larvae taken at Claremont can be best accounted for on the theory that they are mongrels. (See figs. 1, 2, 5 and 6 Pl. III). *Clymene* inhabits the same immediate locality from which most of the *confusa* material has been obtained.

Efforts have been made to obtain a *clymene x confusa* cross but six attempted pairings were unsuccessful.

H. lecontei var. confinis

In 1901, through the kindness of Mr. G. M. Dodge of Louisiana, Mo., I received eggs laid by a captured ♀ Var. *confinis*. From these were reared seven moths, two ♂ and five ♀, all of the fully marked *confinis* pattern and quite uniform.

H. colona var. reversa

In 1904 Mr. Dodge sent me two females of Var. *reversa* one of which is shown on Pl. II at fig. 55. These laid eggs from which were bred in all 21

♂ 14 ♀ fairly uniform in markings and showing no marked departure from the parents. Figs. 56 to 61, Pl. II show the range of variation in the series.

A wider variation than this occurs among these moths as shown by a selected series of captured specimens sent me by Mr. Dodge in which several specimens are immaculate white (*var fulvicosta*) and others intergrading between *fulvicosta* and *reversa*.

In this species and in *lecontei* both of which have immaculate forms, the examples I have examined indicate that the immaculate specimens are more common than those that can be really classed as intergrades. This suggests the theory that the immaculate forms are really "mutations" in the sense in which De Vries uses the word. This is further supported by the following case.

H. lecontei var. vestalis

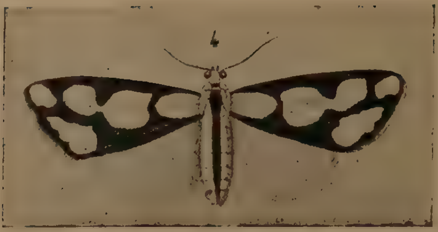
A captured ♀ *vestalis* (fig. 69 Pl. II) sent me by Mr. Dodge in 1904 laid fertile eggs from which were reared 16 ♂ and 10 ♀. Of these 10 ♂ and 8 ♀ were like the mother, immaculate. (See fig. 70, Pl. II). 6 ♂ and 2 ♀ were marked with brown, showing patterns referable to var. *militaris* (fig. 74) var. *confinis* (fig. 75) and var. *harrisii* (fig. 72).

H. lecontei var. harrisii Dyar

A captured ♀ *harrisii* (Pl. I, fig. 62) sent me in 1904 by Mr. H. D. Merrick from New Brighton, Pa., laid eggs from which were bred 3 ♂ and 3 ♀ (see Pl. II, figs. 63-68). These showed quite a range for so small a series, containing forms referable to vars. *harrisii, confinis* and *militaris*.

Typical lecontei Boisd

It seems unfortunate that the type of a species having so many varieties should have been based upon one of the least common of its forms. (See accompanying figure which is a reproduction of Boisduval's illustration of his type.) This form is very rare among collections I have examined. Only two or three moths of those obtained in this locality come very close to it. Figs. 3 and 4 Pl. II bred from larvae taken near Claremont are nearest to the type of any in my collection.



Type of *H. Lecontei* Boisd.
(Reproduction of Boisduval's figure.)

H. clymene

A small series of *clymene* bred from a captured ♀ sent by Mr. Merrick showed no noteworthy variations. *Clymene* appears to be the most constant of any of the species of the genus.

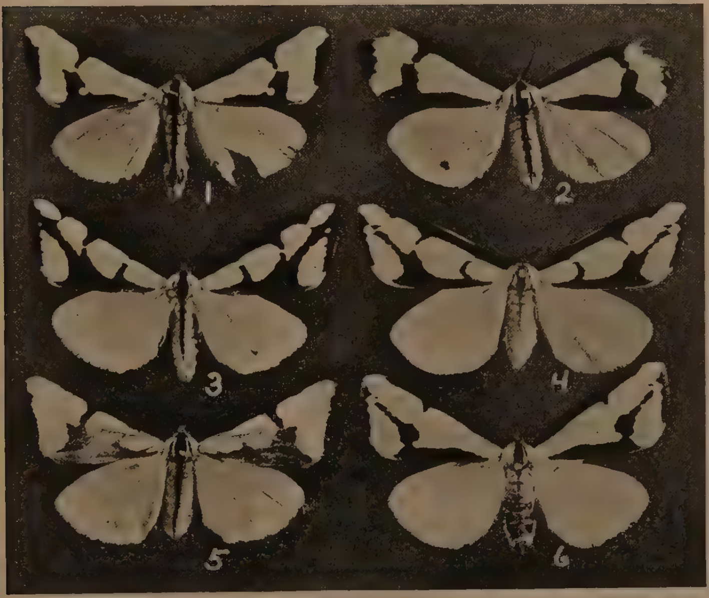
Larval Characters

The larval differences in the genus are not wide and do not appear until after the first or second moult. The following table shows the main points of contrast in the mature larvae:

	DORSAL STRIPE	LATERAL STRIPE	HAIRS
colona	deep red	deep yellow	black or gray
clymene	dull yellow	dull yellow	yellow brown
contigua	dull black	pale yellow	whitish gray
lecontei	yellow orange	yellow	yellowish
var. confinis	black	yellow	black
var. vestalis	dull yellow	dull yellow	black and gray
confusa	bright yellow sometimes orange	dull yellow	black

Studies of the ♀ genitalia have not revealed any constant specific characters in this genus. Differences in form of these organs occur between individuals of the same species and as wide as between those of different species.

The writer is indebted to Mr. G. M. Dodge and Mr. H. D. Merrick for their kind interest in furnishing material for these experiments.



Foster: Haploas.

NORTH AMERICAN BEES OF THE GENERA ANDRENA AND MELITTA IN THE BRITISH MUSEUM.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Andrena aliena, Smith.

St. John's Bluff. Mr. Viereck sent a species of the *Trachandrena* group from Georgia, which was taken for *aliena;* but the true *aliena* is quite different and apparently should be referred to the *Ptilandrena* group. Its distinctive characters, in comparison with the Georgia species, are as follows:

Larger; fimbria lighter and redder; hair-bands very distinct on segments 2 to 4, but broadly interrupted on 2; hind margins of abdominal segments strongly yellowish; punctures of abdomen much less strong and distinct, especially on first segment; area of metathorax triangular, delicately *transversely* striate, not at all longitudinally ridged, not bounded by an elevated rim; wings practically clear; tegulae small, dark reddish, convex, extremely shiny; mesothorax shining; tibiae and tarsi dark, nowhere strongly reddened: facial foveae practically obsolete (a short area without punctures or pubescence adjacent to upper part of eye); hair at sides of face very white; a strong raised line from middle ocellus to level of antennae, antennal joint 3 about as long as 4+5; eyes converging below; stigma narrow, dark reddish, the parts before and behind the marginal nervure about equal; first recurrent nervure joining second submarginal cell at or almost at its middle; marginal cell narrow, its tip distinctly away from costa; outer scopa of hind tibiae very long, somewhat dusky, especially towards base, and very strongly plumose. Altogether, this is a remarkable species.

Andrena frigida, Smith

Mr. Viereck sent for comparison a presumed *frigida* from Seattle, Wash. Comparison with the type showed that they had the same general appearance, pubescence, etc. but although very closely allied, they are not the same species. The type *frigida* differed as follows: stigma lighter and yellower; second submarginal cell larger, and basal nervure meeting transverse-medial; abdomen broader; hind margins of abdominal segments dark reddish; third antennal joint longer than 4+5; facial fovea broad, dark purple-brown (black in Seattle insect); lateral hairs of face, overlapping fovea, black; process of labrum all shiny, narrowly submarginately truncate, with sloping sides (in the Seattle insect with a dull apical protuberant area.)

Andrena moesta, Smith

A Corvallis, Oregon, specimen regarded as *moesta* was sent by Mr. Viereck. Compared with the type, I found the following resemblances and differences: type has outer margin of third submarginal cell much more curved, and a light amber stigma (stigma is dark brown in the Corvallis species): both have the same black facial fovea, the same pubescence, etc., and the abdomen is the same in both; type has fourth and base of fifth antennal joints reddish beneath, but this is not very conspicuous; tegulae of type are distincly reddish behind.

The male type of *moesta* has long and falcate mandibles, without any tooth beneath or at base; cheeks produced to an angle behind.

The Corvallis insect probably should stand as a subspecies. It is recorded by Viereck in *Canad. Entom.* 1904, p. 224.

Andrena (*Trachandrena*) *miranda*, Smith

The type, compared with a supposed *miranda* sent by Mr. Viereck, differed thus:—Ridges of metathoracic enclosure stronger, the surface more shining between; scutellum more densely (though irregularly) punctured, and the punctures larger: when the thorax is viewed from above, the hair of tubercles, etc. in front of the wings, is seen to be strongly yellowish; facial foveae inclining to yellowish grey; an extremely narrow line between facial foveae and eye (a narrow but much broader area in the supposed *miranda*); punctures of clypeus apparently rather larger; third submarginal cell much more narrowed above, narrower above than second. The type has the tibiae and tarsi dark red; it has *not* the margins of the abdominal segments testaceous, or it would seem to run to *claytoniae* in Robertson's tables.

Smith's male *miranda* appears to run in Robertson's tables to *mariae*, or it might be held to run to *claytoniae*. The abdomen is more or less reddish-brown. By the lighter stigma, much less strongly punctured abdomen, etc. it appears not to belong to the same species as the ♀ type.

Andrena fastuosa, Smith

♀ The type is very like *A. argemonis*, Ckll.; it differs by having more black on abdomen, only the second segment being entirely red, or more red than black. The process of labrum is narrower; apex of wings not so dark; first abdominal segment broader. *A. argemonis* is an idiomorph of *fastuosa*.

Andrena errans, Smith

♀ Vancouver I. (*Lyall*). The type looks like *A. vicina* and *carlini*. Hair of face, cheeks, and pleura black; although the wings are quite dark, the stigma is dull amber; clypeus has very close, large punctures, and a well-defined longitudinal ridge; hair of metathorax black, and its enclosure is larger than in *vicina*, its apical angle noticeably larger; it is minutely roughened, with delicate raised wrinkles basally; process of labrum similar to that of *vicina*, but with the truncation not so broad; hair of occiput dark, but there is a tuft of light fulvous hair directed forwards over the ocelli: discs of abdominal segments beyond the first with rather abundant short erect black hair. Perhaps *A. pluvialis*, Ckll., should not be separated specifically from this. The British Museum series consists of six specimens, not all of one species, but the above remarks are based on the one bearing the type label.

Andrena obscuripennis, Smith

♀ A very fine species with extremely dark wings, which expand 30mm. Abdomen with strong punctures; stigma small; tibial scopa dense; area of metathorax pointed behind, not truncate, raised margin slight; anterior middle of clypeus dark red.

Andrena clypeata, Smith

Differs from *A. bipunctata* by being a little smaller (expanse of wings 12mm.) abdomen dark brown. Flagellum dark as in *bicpunctata*; third antennal joint longer than 4, but not nearly as long as 4+5; clypeus yellow with two black spots. Runs to *bipunctata* in Robertson's tables, except that the abdomen is not strictly black. It seems conspecific with *bipunctata*, or perhaps a Floridian race.

Andrena victima, Smith.

♀ The type is stylopized. Fimbria dark brown, a sort of purplish sooty; abdomen not fasciate, sericeous, with only small piliferous punctures; hair of scutellum quite bright orange-fulvous, all the thoracic hair being of this color, though not everywhere so bright; tibial scopa pale orange-fulvous.

The male (type of *A. desponsa*) is also stylopized. In Robertson's tables it seems to run closest to *sayi*. The area of metathorax has some little straight basal ridges, as though puckered. Second submarginal cell large, with recurrent nervure joining it at the middle. Cheeks ordinary.

Andrena hirticeps, Smith

♂ type. Cheeks very broad, angled behind, the angle somewhat above level of middle of eye; mandibles simple at base; hair of clypeus long, white; of sides of face black; third antennal joint about as long as 4+5; nervures and stigma rather light red; abdomen sericeous, with no true punctures; four narlow white hair-bands on *ventral* surface of abdomen. Not in Robertson's tables. The apical ventral valve is broad and emarginate, that is to say, obcordate

Andrena agilis, Smith (Mexico)

♂ type. Hair on sides of face long and black; black hair at junction of cheeks and occiput; large yellow mark on clypeus, rounded above and below, and notched at the sides, with the form of a young agaric with a very thick stipe; wings seem unusually large; basal nervure falling short of transverse-medial by a moderate distance; second submarginal cell at least as broad above as below; third submarginal very broad above; base of abdomen slender.

Andrena simulata, Smith (Mexico)

Hair of thorax quite lively fulvous or tawny; in type specimen the middle of thorax is bare, the hair having apparently been rubbed off. Facial foveae deep, pubescent, brown seen from above, having the form of a somewhat oblique band of no great breadth, its upper end close to the outer ocellus, its lower close to the eye, at about the level of the antennae; thorax and abdomen shining, abdomen broad; tegulae clear amber; first recurrent nervure joining second submarginal cell far beyond its middle.

Andrena (*Pterandrena*) *discreta*, Smith. (Mexico).

Very peculiar for having the abdomen except first segment red (clouded with black), densely covered with short orange hair; fimbria orange; first joint of hind tarsus broad, red; first recurrent nervure joining second submarginal cell *before* its middle; stigma small; facial foveae rather broad, not distinctly separated from eye; first joint of labial palpi curved; about as long as the other three together; hair of thorax fulvo-ferruginous; tegulae amber; tibial scopa dense, plumose.

Andrena modesta, Smith (Mexico)

♀ *Marginal cell squarely* (or rather slightly obliquely) *truncate*; *basal nervure falling far short of transverse-medial*: first recurrent nervure joining second submarginal cell conspicuously beyond its middle; *face black*, very little hairy. facial quadrangle broader than long; *tongue short* (i. e. not as in the Panurgids), maxillary palpi 6-jointed; facial foveae deeply impressed *but not pubescent*, in form small, short and narrow, close to upper part of eye; *area of metathorax not distinct*; abdomen very shiny, yellowish-red, blackened at base and apex. This is not an *Andrena*; it must stand for the present as *Protandrena modesta*, but it is at least the type of a new subgenus of *Protandrena*, which may be called *Austrandrena*. Its principal characters are italicized above.

NEW ANTS FROM NEW ENGLAND.

BY WILLIAM MORTON WHEELER.

While preparing a list of the ants of New England for the Boston Society of Natural History, I have come upon the following new forms in the Museum of Comparative Zoology collection kindly sent me for study by Mr. Samuel Henshaw, in a collection of Massachusetts ants made by Mr. A. P. Morse, and among the material collected by myself at Woods Hole, Massachusetts and Colebrook, Connecticut:

1. *Myrmica rubra laevinodis* Nylander var. *bruesi* var. nov.

A number of workers, females and males taken by Mr. C. T. Brues and myself during 1900 and 1902 from a few large colonies nesting under stones at the edge of Fay's Woods, Woods Hole, Mass., agree very closely with European specimens of *M. laevinodis* from Russia, Austria, Germany, England and Scotland in my collection. The thorax of the workers of the American form is smoother, more shining and less regularly sculptured than in the European specimens, but I am unable to find any other differences of importance, and therefore establish this variety with some hesitation. I should be inclined to regard it as directly imported from Europe were it not that Forel has described two subspecies of *M. rubra* (*M. neolaevinodis* and *M. champlaini*) from New York and Canada respectively, both allied to the European *laevinodis* but with distinctive characters. The former has short antennæ, with the tips of the scapes extending only a short distance beyond the posterior corners of the head, the latter has very short epinotal spines. It thus appears that America possesses indigenous forms closely related to *laevinodis*, just as it has long been known to possess numerous varieties of the other boreal and subboreal subspecies of *M. rubra*.

2. *Lasius flavus nearcticus* subsp. nov.

Lasius flavus Emery, Zool. Jahrb. Abth. f. Syst. VII, 1893, p. 640,

Lasius flavus subsp. *myops* Emery, *ibid.* VIII, 1894, p. 334.

Lasius myops Wheeler, Bull. Am. Mus. Nat. Hist. XXI, 1905, p. 397.

This form, which Emery and myself have been regarding as *L. flavus myops* Forel, originally described from the Mediterranean Region, is certainly distinct, as I find by comparison of workers from Illinois, Massachusetts, Connecticut, New York and New Jersey with three typical workers kindly sent me by Professor Forel. According to this authority *myops* is distinguished from the typical *flavus* of Europe "by its much smaller eyes, paler color, smaller and less variable stature, the absence of large reddish brown individuals, and finally by its predilection of warm, arid regions, where it lives under stones, unlike the true *flavus,* which prefers fat, humid meadows and makes large, compact mound nests." The worker of our American form of *flavus* undoubtedly resembles *myops* more closely than it does the typical *flavus* in the small eyes and paler color, but it is somewhat larger than *myops* (2.3-2.6 mm.), has the head and thorax smoother and more shining and the eyes proportionally even smaller. It differs, moreover, from *myops* in its habits, as it is found only in damp soil in shady woods, where it nests under dead leaves, stones or logs in colonies which are very small compared with those of the European *flavus.* These ethological differences are, in my estimation, a clearer indication of the independent subspecific rank of the American form than the morphological characters, although the discovery of the females and males of *myops* and their comparison with the corresponding phases of *nearcticus* may facilitate the separation of the two forms in our collections.

3. *Formica morsei* sp. nov.

Worker. (Plate IV. Fig. 1 a-c). Length 3.5-55 mm.

With the habitus of a small *F. rufa.* Mandibles 8-toothed. Palpi rather long. Head, excluding the mandibles, distinctly longer than broad; cheeks long, slightly flattened, converging in front, posterior border and angles convex and rounded. Clypeus convex, carinate, with entire, rounded anterior border. Antennæ slender; four basal joints of funiculus longer and more slender than the terminal joints. Thorax in profile with deep mesonotal constriction, the pro-and mesonotum together and the epinotum singly, rounded and convex. Petiole much narrower than the epinotum, both its anterior and posterior surfaces alike convex in profile; seen from behind the border is broadly rounded, in some specimens faintly emarginate in the middle, but not produced upward at this point as in many forms of the *rufa* group. The edge is rather blunt. Gaster large. Legs of the usual conformation.

Mandibles shining, sharply striatopunctate. Anterior portion of head, clypeus, frontal area, lower surface of thorax and gaster, shining; remainder of body subopaque, very finely shagreened; upper surface of gaster with a slightly oily luster.

Hairs white, obtuse, suberect and very sparse on the upper surface of the head, thorax and gaster; nearly always completely absent on the lower surface of the head and petiolar border. Femora naked; tibiae with a row of tapering hairs on their flexor surfaces. Pubescence white, extremely short and sparse, so that it is almost invisible except on the upper surface of the gaster.

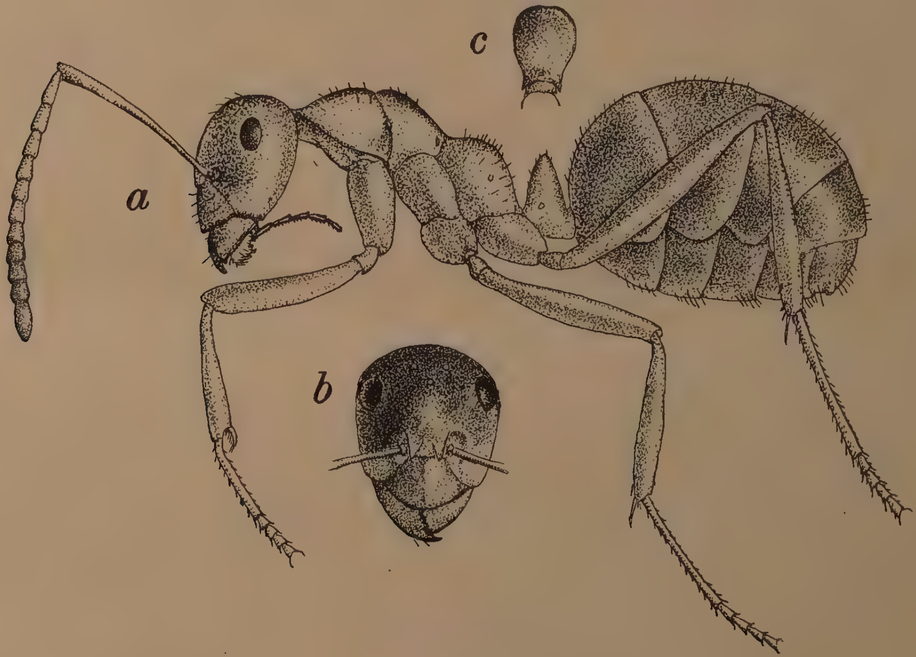
Reddish yellow; borders of mandibles black; anterior border of clypeus, vertex, upper surface of pro-and mesonotum, femora, tibiae, apical antennal joints, and gaster more or less infuscated; anal region yellow. In many specimens the upper surface of the head is more reddish than the remainder of the body but there is little difference in coloration between the smallest and largest workers.

Described from many workers taken by Mr. A. P. Morse from a flourishing colony at South Natick, Mass. This form is very closely related to some of the smaller American *Formicae* of the *rufa* group. Its exact status and affinities, however, cannot be determined without a knowledge of the female. It can hardly be a mere variety or subspecies of *F. rufa* proper, and it certainly has a very different habitus in coloration and pubescence from any of the allied species known to me.

4. *Formica impexa* Wheeler.

Of this interesting species, originally described from workers only, taken in the Porcupine Mountains of Northern Michigan, Mr. A. P. Morse has recently discovered a colony at Sherborne, near East Holliston, Massachusetts. It was nesting in the upright trunk of a white pine, between bark and wood, about three feet from the ground and contained a few of the hitherto unknown females. These very closely resemble in their diminutive size (4.5 mm. in length) and coloration the females of the species which I have described as *F. microgyna, nevadensis* and *nepticula*, but the whole body, antennal scapes and legs are covered with long, suberect, obtuse hairs. They agree with the female of *microgyna* and differ from those of *nepticula* and *nevadensis* in having the gaster opaque and densely grayish pubescent.

The discovery of these diminutive females not only proves that I was not mistaken in regarding *impexa* as specifically distinct from *F. rufa,* but also indicates that, like *F. difficilis* and *microgyna*, it is a temporary parasite in depauperate colonies of some other species of *Formica*. As a matter of fact, the vial containing the *impexa* workers and females also contained a number of workers of *F. fusca* var. *subaenescens,* which Mr. Morse collected at the



Formica Morsei sp. nov.

same time. Although he was under the impression that these black workers might be slaves of the *impexa,* he was not sure that they actually formed part of a mixed colony. It is evident, however, that these species which both happen to be members of our boreal fauna, must have been nesting very near each other.

5. *Camponotus herculeanus ligniperdus* Latreille var. *rubens* var. nov.

Female. Differing from the female of the var. *novaeboracensis* Fitch (*pictus* Forel) in having all the gastric segments deep red except their posterior margins, which are black.

Male. Indistinguishable from the male of *novaeboracensis.* Worker forms unknown.

Described from the following specimens from the collection of the Museum of Comparative Zoology: Two females from Norway, Maine (S. J. Smith); one female and one male from Bethel, Maine (A. M. Edwards); and four females collected in Michigan by Dr. Clark in 1864.

THE BEDBUG, CIMEX LECTULARIUS[a] *LINNAEUS.*

Pt. II[b]. Critical remarks on its literature, with a history and bibliography of pathogenic relations.

BY ALECANDRE ARSENE GIRAULT, WASHINGTON, D. C.

A full bibliography of this insect, as promised in Part I of this paper, had to be abandoned because of its length. In contemplating its publication, the writer had in mind, mostly, its hoped for usefulness to both entomologists and medical men.

[b] Part I, Psyche XII, 1905 pp. 61–74.

Such a common, and persistently obnoxious insect must necessarily have a very extensive literature, and one that is much scattered, especially since it is a factor directly affecting the social communities of man himself.

In reviewing this body of literature, the writer has been continually impressed by one fact in particular, namely, that in the economic discussion of the bedbug by entomologists, the latter show almost an entire lack of knowledge of its medical literature; and so, conversely, the medical profession in discussing its hygienic, pathological or sanitary relation to man, quite often show great deficiency in their knowledge of its entomological literature. This has, therefore, led to many misleading, erroneous, and loose statements concerning the habits of the pest, made especially, however, in the medical literature and in the writings of zoologists and naturalists. These classes of writings have been found, in nearly all cases, to have been compiled from various unknown sources, both good and bad; the statement of course excepts the literature of experimental medicine. In the latter class of writings, the only fault to be found is the continual use of local or common names instead of the scientific one, such as, for instance, *bug* by the English, *wanze* by the Germans, *punaise* by the French, and so on. This use of vernacular names has thrown doubt on the value of the experiments performed, for the reason that they are entirely too general in their application.

Another point which has very forcibly struck the writer, is the great disproportion between the literature of this insect *en masse*, and the *real* facts now known concerning its habits and life history.

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[a] By request, Dr. Ch. Wardell Stiles has carefully studied the synonomy of this insect, and has decided that *lectularius* is the type of *Cimex* Linnaeus. The insect will therefore retain its original name. *Acanthia*, *Klinophilos*, and *Clinoris* are rejected. Dr. Stiles' note will appear in Proc. Ent. Soc. Washington, VIII, 1906, probably in June of the present year.

The great majority of the accounts are simply re-compilations and appear to have no other purpose than to cover so much space in as rapid a manner as possible, as if the discussion of the bedbug was simply a matter of course, or of duty; to some it actually appeared to be distasteful, doubtless through false modesty. The addition of new facts was exceptional; unfounded statements, however, the rule. So that, taking the whole body of literature, we know more about the bedbug, *theoretically* than we do *actually*, a seeming paradox. The accounts by Southall (1730), De Bomare (1764), DeGeer (1773), Jördens (1801) and Curtis (1835) were good authorities even up to the last two decades, as late as 1890. Southall was probably the source of them all.

A state of affairs of this kind in the history of any insect, especially an important insect, should not be. It is true, that the majority of the accounts published on the bedbug were meant for the information of the general public, and were written in a popular way, but that fact does not excuse the carelessness with which they were compiled, especially since they were written by scientific men. In the remainder of the accounts, which were published as contributions to the knowledge of science, it would at least be expected to find something that really contributed, that were new facts.

In contrast to the great majority of writings on *lectularius*, however, the literature concerning its pathogenic relations is more careful in statement, and less obscure in meaning. This is to be expected from its nature, because experimental evidence is generally presented in the form of a clear statement of facts. But, notwithstanding this, nearly every paper which has been consulted, lacked one essential thing,—the scientific name of the insect in question. Until the species of insect with which experiments are being performed, is definitely known, uncertainty will always attend the results. This is especially true in the case of the bedbug and its near relatives, as just recently pointed out (Girault and Strauss, 1905). Unless the Latin name of the insect was given in the articles on the pathogenic relations, the conclusions drawn from the experiments recorded were always accompanied with doubt as to whether *lectularius*, *columbarius* Jenyns, or one of the other allied species were meant. Any one of the allied species would probably have behaved toward the small mammals used as hosts, as recorded in the experiments. Hence, the confusion.

As the writer has already given several practical illustrations of the poor character of some of the literature of this insect in part I of this paper pp. 61, 72–74) and in a recent paper on host relations just mentioned (Girault and Strauss, 1905), and as he hopes to present elsewhere an abstracted bibliography of the whole, he considers it unnecessary to go into the subject deeper. Suffice it to say, that the few brief criticisms made on the literature of the bedbug, showing as it does needless repetition and speculation. should serve to warn us, in a measure, to be more careful in compiling accounts of our common economic insects, and furthermore, should urge us to make at least some effort to add new facts.

On account of the interest now being shown in the rôle of various insects in the transmission of diseases, and in order to attract the attention of entomologists to the bedbug's rôle in transmission, a brief history of its pathogenic relations follows.

In 1887, the famous Metschnikoff, in an article on certain phases of relapsing fever published in a well-known medical journal of Berlin, made general references to the bedbug as a carrier of diseases. This is believed to be the first time that the idea was definitely mentioned, and Metschnikoff may be held to be the originator of it.

A period of about five years then elapsed before anything more was said about the question, when in 1892 a Dr. Dewévre published in Paris an account of a supposed case of the transmission of tuberculosis, which he discussed at length, and tried to establish. His evidence was quite insufficient, and the whole case did no more than to throw grave suspicions on the bedbug. This article was reprinted in the *Medical Record* of New York, and in the year following it was reviewed in *Insect Life*, a periodical published by the then Division of Entomology, U. S. Department of Agriculture, and in the *American Monthly Microscopical Journal* of Washington. Since then the case has been quoted and reviewed from time to time in medical journals and general treatises on medicine. It was founded on suspicious circumstances only.

In 1895, M. Morau, a Frenchman, published in the *Revue Scientifique* of Paris, an article on the contagiousness of cancer, in which he tried to establish, by means of experiments, that bedbugs carried the causitive agent of that disease. The experiments were entirely negative.

Two years later, articles ascribing to the bedbug means of spreading diseases became more or less common. Dr. George H. F. Nuttall, formerly of Johns Hopkins University, Baltimore, then began his series of important experiments on the rôle of insects in the spread of diseases, which were continued over several years and then, in the year 1900, summarized, together with a critical and historical study of the whole question. The possibility of the transmission of relapsing fever by bedbugs was considered by a Dr. Tictin, with negative experiments, while a Japanese writer, M. Yamagiwa, stated definitely that out of a large number of clinic cases of bubonic plague, one case was caused by the bite of a bedbug.

In the following year, 1898, Dr. Charles F. Craig, then Acting Assistant Surgeon, U. S. Army, quoted the cases of Tictin and Morau, and called attention to the lack of knowledge of the question involved. Experiments on the transmission of anthrax by bedbugs were recorded by M. Joly, with negative results while one of his fellow-country men, Dr. Simond of the Pasteur Institute, stated in a lengthy article on bubonic plague, that the flea and the bedbug were the two "parasites", *a priori*, which were able to assume a rôle in the transmission of that dangerous disease. He thought it probable that the bedbug intervened in the transmission of that disease from man to man.

During 1899, MM. Calmette and Salembeni, in the annals of the Pasteur Institute, wrote of a case of bubonic plague in which the bedbug's bite formed a starting point of the disease. During the same year, Dr. Carmichael, of the U. S. Marine-Hospital Service, said,—"It is suspected that certain insects play a part in the transmission of leprosy, the common housefly, mosquito, and bedbug being the principal carriers of infection." In 1899, Dr. Coplin, of the Jefferson Medical College, Pennsylvania, proved that pure cultures could be inoculated from infected bugs; the infections were those of typhoid fever. After discussing the parts played by household insects in spreading certain diseases, he concludes by saying, "The danger from the bedbug and roach would probably be great in diphtheria and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases." But conclusions opposite to this were reached by Muhling in a paper published at Jena about the same time. He concluded that of themselves, bedbugs could not carry contagions, but that their bites would naturally form a *porte d'entrés* for pathogenic bacteria.

With the exception of minor articles, the only other important writing which has been published on bedbugs and their relations to human diseases is that of Dr. Nuttall, mentioned in foregoing. This was first published at Berlin, in 1899, and reprinted the following year in the *Johns Hopkins Hospital Reports*. (Nuttall, 1900.) It critically discussed all the experimental evidence then recorded concerning the transmission by bedbugs of anthrax, bubonic plague mouse-septicemia, chicken-choleɪa, *Bacillus septicus*, relapsing fever, and tuberculosis. Nuttall concluded that nothing had been positively proven, and his conclusion holds up to the present time.

BIBLIOGRAPHY OF THE PATHOGENIC RELATIONS OF THE BEDBUG.

1887. Metschnikoff, Elias. Ueber dem phagocytenkampf beim rückfalltyphu s Archiv f. pathologische anatomie und physiologie, und f. klinische medicine, herausgegeben von Rudolf Virchow (Virchow's Archiv) Berlin, Bd. 109, pp. 176–192.
General references to transmission of diseases by the bedbug.

1892 a. Dewèvre, (Docteur). Note sur le role des pediculi dans a propagation de l'impétigo. Comptes rendus hebdomadaires des lséances et mémoires de la Soc. de biologie. Paris, tome quatrième, nevième séries· pp. 232–234.
From Nuttall (1899), p. 32. The reference is evidently a wrong one; tuberculosis and the bedbug are not mentioned.

1892 b. Dewèvre, (Docteur). Note sur la transmissibilité de la tuberculose par la punaise des lits. Revue de médicine, Paris, XII, pp. 291-294.
Account of a case of supposed transmisison, with discussion. "La punaise des lits peut donc jouer quelquefois un rôle assez important dans la propagation de la tuberculose, et nous estimons qu' à l'avenir l'hygiène devra tenir compte de ce facteur noveau en édictant les règles minutieuses de la désinfection." P. 294.

1892. Editors. Bedbugs—. Medical Record, New York XLII, p. 347. Brief summary of Dewèvre (1892 b). Cf. Riley and Howard (1893).

1893. Riley, Charles Valentine and Leland Ossian Howard. An insect transmitter of contagion. Insect Life, U. S. Dep. Agric., Division Ent., Washington, V, p. 210.
Quote Editors (1892).

1894. Alleger, W. W. On the limitation of tuberculosis. Bedbugs as sources of infection. American monthly microscopical journal, Washington,

XV, pp. 295–296.
Briefly gives statements of Dewèvre (1892).

1895. Morau, Henry. Le cancer est contagieux. Revue scientifique, Paris, LV, (III, séries 4), pp. 42–43.
Brief account of experiments with bedbugs.

1896. Galli-Valerio, Bruno. Manuele di parassitologia in tavole sinottiche (vermi e artropodi dell'uomo e degli animali domestici), Milano, pp. 124–125, tavola LXIII.
Listed as *Acanthia lectularia*, with a note to the effect that it is supposed to trasmit tuberculosis.

1897. Editors, (J. H.) Les punaises et les moustiques comme agents de contagion. Revue scientifique, Paris, LIX, (VII, series 4), pp. 110, 112–113.
Review of experiments on the relation of bedbugs to infections in general. Vide Tictin, 1897.

1897. Marpmann, G. Ueber den zusammenhang von pathogenen bakterien. mit fliegen. Centralblatt f. bakteriologie, parasitenkunde und infektionskrankheiten, Jena, Bd. XXII, erste abteilung, pp. 127–132.
Includes theories concerning the relation of bedbugs to pathogenic bacteria of animals and man. Vide Nuttall (1899) p. 23.

1897. Nuttall, George H. F. Zur aufklärung der rolle, welche die insekten bei der verbreitung der pest spielen.—Ueber die empfindlichkeit verst chiedener tiere für dieselbe. Eine experimentelle studie. Centralblats f. bakteriologie, parasitenkunde und infektionskrankheiten, Jena, Bd XXII, erste abteilung, pp. 91–93, (Versuche mit Wanzen).
Inoculation experiments with *wanzen*, using as hosts small mammals. For general review, vide Nuttall (1900).

1897. Tictin, J. Zur lehre von ruckfalltyphus. Centralblatt f. bakteriologie parasitenkunde und infektionskrankheiten, Jena, Bd. XXI, erste abteiling, pp. 181, 182–186.
"Ueber die Möglichkeit der Uebertragung Ruckfalltyphus durch Wanzen". Relation of bedbugs to "*Febris Recurrens*", with negative experiments.

1897. Yamagiwa, K. Ueber die Bubonenpest. Archiv f. pathologisches anatomie und physiologie, und f. klinisches medicin. Herausgegeben von Rudolf Virchow (Virchow's Archiv), Berlin, Bd. 149, supplementheft, p. 109.
"Ausserdem habe ich bei einem Patienten (Fall LII) in dem Granulationsgewebe des vor der Erkrankung durch dem stich einer Bettwanze entstandenen Gescwurs am linken Unterschenkel, auf * * * * *."

1898. Craig, Charles F. The transmission of disease by certain insects: ticks, bedbugs, ants, etc. Bedbugs and the transmission of disease. New York Medical Journal, New York, LXVIII, pp. 598–599, figs. 3–4.
Quotes Westwood (1840) and Uhler (1884), and gives the substance of the experiments of Titkin (Tictin, 1897) and Morau (1895); figures from Osborn (1896). Lack of knowledge of the question involved.

1898. Joly, Raoul Adrian Paul. Importance du rôle des insectes dans la transmission des maladies infectieuses et parasitaires. Du formal comme insecticide. Bordeaux, thèse, 90 pp.
Includes experiments with bedbugs and anthrax; rabbits used as host. Experiments negative.

1898. Nuttall, George H. F. Zur aufklärung der rolle, welche stechende insekten bei der verbreitung von infektionskrankheiten spielen. Infektionsversuche an mäusen mittels mit milzbrand, huhnercholera und mäuseseptikämie infiezierter wanzen und flohe. Centralblatt f. bacteriologie, parasitenkinde und infektionskrankheiten, Jena, Bd. XXIII, erste abteilung, pp. 625–635.
Important inoculation experiments with *wanzen*. Cf. Nuttall (1900).

1898. Simond, P. L. La propagation de la peste. Annales de l'institut pasteur, Paris, XII, pp. (625–687), 672–673, 677, 687.
"La puce et la punaise sont les deux parasites qu'on peut, *a priori*. soupçonner de jouer un rôle dans la transmission du bacille de la peste." pp. 672–673.
"* * * par certaines particularités de la transmission du rat à l'homme et d'homme à homme; pour ce dernier cas, il est possible que d'autres parasites, enparticulier punaise, interviennent; * * * * *". P. 687.

1899. Abbott, Samuel W. Public hygiene and preventive medicine. The

management and control of infectious diseases. Insects as transmitters of infection. The American year-book of medicine and surgery, Philadelphia, (Gould), pp. 996–997.
A digest of the experiments of Nuttall (1897, 1898). Bedbugs transmit but rarely.

1899. Calmette, A. and A. T. Salimbeni. La peste bubonique. Etude de l'épidémie d'Oporto en 1899, Sérothérapie. Annales de l'institut pasteur, Paris, XIII, p. 883.
"* * * * *, le point de départ de la lésion avait été une piqûre de punaise." Observations.

1899. Carmichael, D. A. Leprosy in the Hawaiian Islands. The Medical News, New York, LXXIV, p. 95.
Abstract from Public Health Reports, to Supervising Surgeon-General, U. S. Marine-Hospital Service, Dec. 30, 1898.
"It is suspected that certain insects play a part in the transmission of leprosy, the common house fly, mosquito, and bedbug being the principal carriers of the infection."

1899. Coplin, William M. Late. The propagation of diseases by means of insects, with special consideration of the common domestic types. Philadelphia med. journal, Philadelphia III, pp. 1303–1307, 6 text-figs.
Address delivered before the Pennsylvania State Medical Society, Johnstown, Pennsylvania, May 17, 1899.
General account of the part played by household insects in transmitting diseases, with an account of experiments performed with bedbugs roaches, and flies as carriers of bacteria, especially the bacilli of typhoid fever. Figures petri cultures made by contact with infected bugs.
"The danger from the bedbug and roach would probably be great in diptheria, and all would share in the possible dissemination of tuberculosis, anthrax, and similar bacterial diseases." p. 1306.

1899. Mühling, Paul. Die uebertragung von krankheitserregern durch wanze und blutegel. Centralblatt f. bakteriologie, parasitenkunde and infectionskrankheiten, Jena, Bd. XXV, erste abteilung, pp. 703—706.
Original experiments with bedbugs. "Aus allen diesen Thatsachen ergeibt sich also sicher; dass der Wanzenstich an sich nichts zu bedeuten

hat, abgesehen natürlich von der dadurch gesetzten Hautläsion, welche spater eine porte d'entrée fur Bakterien sein kann, dass er aber durch Zerquetschen und Zerreiben des Blutsaugers an der gestochenen Stelle gefährlich werden kann insofern, als Mikrooganismen in den Stichkanal eindringen, welche oberflächlich der Wanze anhaften oder in Darme derselben enthalten sind." p. 705.

1899. Nuttall, George H. F. Die rolle der insekten, arachniden (Ixodes) und myriapoden als trager bei der verbreitung von durch bakterien und thierische parasiten verursachten krankheiten des menschen und der thiere. Eine kritisch-historische studie. Hygienische Rundschau, Berlin, IX, pp. 218–220, 277–278, 279, 280, 281, 283, 394–395, 400.
Historical and experimental evidence of the transmission of diseases by the bedbug; its relation to anthrax, plague, mouse septicema, chicken-cholera, *Bacillus septicus*, relapsing fever, and tuberculosis. Criticism and review of all experiments to date. Vide Nuttall (1900).

1899. Popoff, Leo. Relapsing fever. Twentieth century practice. An international encyclopedia of modern medical science by leading authorities of Europe and America, New York, XVI, infectious diseases, p. 476.
Gives the results of Titkin (Tictin 1897).

1900. Nuttall, George H. F. On the rôle of insects, arachnids and myriapods as carriers in the spread of bacterial and parasitic diseases of man and animals. A critical and historical study. Johns Hopkins Hospital Reports. Baltimore, VIII, pp. 13–14, 17, 18, 20, 22–23, 24–25, 32–33, 39, 120.
About the same as Nuttall (1899).

1900. Packard, Frederick A. Transmission of infectious agents by insects. Progressive medicine, Philadelphia and New York, I, pp. 136–138.
Review and digest of Nuttall (1900) and Coplin (1899).

1900. Riesman, David. The role of insects, arachnids, and myriapods as agents in the spread of diseases due to bacteria or to animal parasites in men and animals. American year-book of medicine and surgery, (Gould), Philadelphia, Medicine, p. 324.
Digest of Nuttall (1899) and Coplin (1899); no proof of the conveyance of tuberculosis has been furnished.

1901. Dawson, Charles F. The dissemination of infectious diseases by insects. American veterinary review, New York, XXV, p. 267.
Quotes the case of Dewèvre (1892).

1901. Homan, George. On the agency of parasitic vermin and other insect pests in the spread of disease. American medicine, Philadelphia, II, pp. 536–537.
Read before the Division of Maritime Hygiene and Quarantine, Third Pan-American Medical Congress, Havana, February, 1901. General article; contains the following very interesting sentences:—"One of the most cosmopolitan and formidable of human parasites remains to be mentioned—Cimex lectularius—and one whose potency for harm in a public health sense has hardly been adequately measured perhaps by reason of its * * nocturnal habits * * * * *.
* * * * * *, but its activity in temperate climates coincides very nearly with the usual maximum prevalence of yellow fever and malarial diseases * * * * * * * *. Its stubborn inhabitancy of human dwellings, however, points significantly to it as at least a coadjutor in the persistence of the first-named disease, where it is endemic, and as an influential agent in the spread of other infections as certain forms of tuberculosis, syphilis, leprosy, carcinoma, and peradventure bubonic plague." p. 537.

1902. Flügge, Carl. Grundriss der hygiene fur studirende und praktische ärtze, medicinal— und verwaltungsbeamte. Leipzig, funfte, vermehrte und verbesserte auflage, pp. 473, 532, *et al.* Edit. 1, 1891.
Believes that vermin in general spread *Febris recurrens.*

1902 a. Howard, Leland Ossian. How insects affect health in rural districts Farmer's Bull, No. 155, U. S. Dep. Agric. Washington, p. 18, fig. 15 Yearbook U. S. Dep. Agric., Washington, 1901, p. 190, fig. 19.
Contains the following sentence, in referring to the transmission of diseases by insects, "Even the common bedbug is strongly suspected in this connection." Figures adult.

1902 c. Howard, Leland Ossian. Mosquitoes. How they live; how they carry disease; how they are classified: how they may be destroyed. New York, p. 65.
Grassi (1900) excludes the bedbug and others from being possible car-

riers of malaria, on the strength of their wide distribution. Grassi has not been seen, and is not listed.

1903. Jennings, William Ernest. A manual of plague, London, p. 32.
Bugs may be carriers of plague.

1904. Bergey, D. H. The principles of hygiene. A practical manual for students, physicians, and health-officers. Philadelphia, New York and London, edit. 2, revised, pp. 378, 390, 391, 394, 400, 412.
The bedbug is believed to be instrumental in disseminating the parasite of relapsing fever; and other diseases.

1904. Herzog, Maximilian. The plague: bacteriology, morbid anatomy, and histopothology, including a consideration of insects as plague carriers, Bull No. 23, (U. S.) Dep. Interior, Bureau Govt. Laboratories, Boil Laboratory, Manila, pp. 75, 83.
States Nuttall's (1897) results; bacteriological examination of five bedbugs taken from a room in which a plague patient slept.

1904. Titus, Edward Sharpe Gaige and Frederick Charles Pratt. Catalogue of the exhibit of economic entomology at the Louisiana purchase exposition, St. Louis, Mo., 1904. Bull. No. 47, U. S. Dep. Agric., Bureau Ent., Washington, p. 120.
Listed under the heading, *Insects which may spread disease.*

1905. Bolduan, Charles and Mary E. Goodwin. A clinical and bacteriological study of the communicability of cerebro-spinal meningitis and the probable source of contagion. Medical news, New York, LXXXVII. p. 1226.
"The vermin theory of infection also presupposes the presence of the meningococcus in the peripheral blood of the patients. * * * * * * * * * * *. Even when present it does not appear to be so abundant that fleas or bedbugs would be likely to ingest one very often."

1905. Girault, Alecandrè Arsène and John Frank Strauss. The bedbug, *Clinocoris lectularius* (Linnaeus), and the fowl-bug, *Clinocoris columbarius* (Jenyns:) host relations. Psyche, Cambridge, Mass., XII, pp. 117–120.
Adults and larvae attacked in confinement recently dead, and living, mice. Brief discussion of host relations. Cf. Laidy, 1877, Proc. Acad.

Nat. Sciences, Philadelphia, XXIX, p. 284.

1905. Harrington, Charles. The relation of insects to human diseases. Bedbugs. A manual of practical hygiene for students, physicians, and medical officers. Edit. 3, revised, Philadelphia and New York, pp. 640–641. Dewèvre's (1892) case cited. Nuttall's (1899) experiments negative. Muhling (1899) agrees that no danger of infection is to be apprehended from the bites alone.

1905. Radcliffe-Crocker, Henry. Animal parasites of the skin. Diseases of the skin, their description, pathology, diagnosis, and treatment, with special reference to the skin eruptions of children. Edit. 3, revised, Philadelphia, II, pp. 1357, 1386.

By H. Radcliffe Crocker, Edit. 1, 1888, London and Philadelphia, pp. 708–709. Edit. 2, 1893, London, p. 877. Edit. 2, 1893, Philadelphia, p. 925.

Brief description of the bite with treatment.

1905. Simpson, W. J. A treatise on plague, dealing with the historical, epidemiological, clinical, thereapeutic, and preventive aspects of the disease. Cambridge, p. 222.

Gives the case of Calmette and Salimbeni (1899).

1905. Walsh, James J. (Anon). Disease and dirt and the tramp. The Independent, New York, LVIII, pp. 680–681.

Lengthy editorial on probable transmission of cerebro-spinal meningitis by insect blood parasites. Reference to the transmission of relapsing fever by the bedbug.

For reference to a few, apparently, unimportant papers not listed or seen, consult Tictin, 1897.

LITERATURE REFERRED TO IN PARTS I & II

1730. Southall, John. A treatise of buggs: showing when and how they were first brought into England. How they are brought into and infect houses. Their nature, several foods, times and manner of spawning and propogating in this climate. Their great increase accounted for, by proof of the numbers each pair produce in a season. Etc., Etc., London, v–xii+44 pp.; frontispiece of 16 figures. Hamburg, 1737; Berlin 1742; new edit. 1793.

A very full account of *lectularius*, monographic in nature, which strangely has been followed by many to date. A copper-plate is given of 16 duplicate figures of the eggs, larvae at weekly periods of growth, European and American specimens, all said to be of natural size, and of an enlarged adult; figures nearly recognizable. Recommends winter treatment, simple furniture, and avoidance of soft woods, second-hand furniture, and washerwomen. The account of course is full of errors, due to the times. Southall states that he could find no works on *lectularius* previous to his. No references are given.

1764. De Bomare, Valmont. La punaise de lit, *Cimex domesticus.* Dictionnaire raisonné universal d'histoire naturelle; contenant l'histoire des animaux, des végetaux et des minéraux, et celle *etc.*, *etc.* Paris, tome quatrième, pp. 519–522. An old, but important, account.

1773. De Geer, Carl. Punaise des lits. Memoires pour servir à l'histoire des insectes, Stockholm, III, pp. 296–305, pl. 17, figs. 9–15.
Good account. Synonomy; origin, description, habits, feeding-habit and effect of bite; remedial measures with experiments; predaceous enemies; recommendations; length of life without food. Cf. Jordens (1801) p. 33. Latreille (1807) and Westwood (1840), gives wrong reference.

1801. Jordens, Johann Heinrich. Die Bettwanze. Entomologie und helminthologie des menschlichen korpers, oder beschreibung und abbildung der bewohner und feinde desselben unter den insekten und wurmern. Hof, erster band, pp. v, 32–40, tab. I, figs. 16–25.
Description of the egg, young and adult; external sexual characters; distribution and occurrence; effect of bite; De Geer's observations on the effect of the attack on two persons; enemies; remedies; figures with details. A very important account, with apparently complete bibliography to date.

1807. Latreille, Pierre André. Genera crustaceorum et insectorum secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata. Parisiis et Argentorati, tomus tertius, p. 137. Paris, 1807, pp. 36–37.
Defines *Cimex* and fixes *lectularius* as type.

1833. Dufour, Léon. Recherches anatomiques et physiologiques sur les Hemiptères, accompagnées de considérations relatives à l' histoire naturelle et à la classification de ses insectes. Mémoires des Savants etranger a l' Acad. de Science, Paris, IV, pp. 184 ff. Separate, Paris 1833.
From various authors. Vide Landois (1869) p. 230. Not seen. Much quoted.

1835. Curtis, John. *Cimex lectularius.* The House—or Bed-bug. British Entomology, London, XII, p. 569, pl. 569, 9 figs.
Description and history of distribution; remedial measures. Good, colored figure of adult, with details.

1839. Jenyns, Leonard. On three undescribed species of the genus *Cimex* closely allied to the common bed-bug. Annals and Mag. Natural Hist., London, III. pp. 241–244, pl. V, figs. 1–3.
(? Isis, 1844, XI, p. 830.)
Original descriptions of *Cimex columbarius*, *hirundinis*, and *pipistrelli*, with characteristics of each and a synoptic table of the species including *lectularius.* Hagen (1862, *Bibliotheca Entomologica*, Leipzig) gives wrong reference.

1840. Westwood, John Obadiah. An introduction to the modern classification of insects; founded on the natural habits and corresponding *etc.* London, II, pp. 465, 474–477, fig. 121, 1 and 4. Synopsis, p. 120.
Restricts *Cimex* to one species, *lectularius.* Good account, mostly historical. Figures poorly the adult and larva.

1855. Fitch, Asa. The Chinch Bug. Rep. on the noxious, beneficial, and other insects of the State of New York, in Trans. New York State Agric. Soc., XV, p. 523. Separate, 1856, Albany, p. 291.
Mentions the change in application of the word *chinche* from *lectularius* to *Blissus leucopterus* Say.

1868. Landois, Leonard. Anatomie der Bettwanze (*Cimex lectularius* L.) mi Beruchtigung verwandter Hemipterengeschlechter. Zeitschr, f. wissenschaftliche zoologie (Siebold und Kolliker), Leipzig, Band XVIII, pp 206–224, tafeln XI–XII, figs. 1–14.
Brief history; names; anatomy of the digestive organs; of the salivary glands; and of the odoriferous glands, with good figures. Continued in Landois (1869).

1869. Landois, Leonard. Antomie der Bettwanze (*Cimex lectularius* L.) miberüchsichtigung verwandter Hemipterengeschlechter. Zeitschr. f. wissenschaftliche zoologie (Siebold und Kölliker), Leipzig, Band XIX, pp. 206–233, tafeln XVIII–XIX, figs. 1–25.

A continuation and conclusion of Landois (1868). Anatomy of the organs of respiration ; of the fat bodies ; of the male and female reproductive organs, including a description of the ripe egg ; of the nervous system ; of the body segments, wing covers and legs ; and of the muscles. Also a list of 25 titles, and four references to figures.

1884. Uhler, Philip Reese. Standard Nat. History, Boston, II, p. 285, fig. 328. Riverside Nat. History, Boston and New York, II, p. 285, fig. 328. Brief account, with figure. Osborn (1896) gives wrong reference, which is copied by Craig (1898).

1885. Lintner, Joseph Albert. The bed-bug infesting a library. Second Rep. on the injurious and other insects of the state of New York, Albany, pp. 16–18, 152.

Quotes correspondent ; house found infested, the insects hiding in numbers in books and files of papers. Brief history and habits, with remedies. On p. 152, a note in regard to other applications of its common names. (Vide Fitch, 1855.)

1886a. D'Herculais, Jules Kunckel. La punaise de lit et ses appareils odoriferants.—Des glandes abdominales dorsale de la larve et de la nymphe ; des glandes thoraciques sternales de l'adulte. Comptes rendus de l'Academie des Sciences, Paris, CIII, pp. 81–84. Separate, Paris, 5 July, 1886, 4 pp.

Preliminary description of the oderiferous glands of the larva and adult. Cf. D'Herculais (1886b).

1886b. Idem. La punaise de lit et ses appareils odoriférants -Changement de situation et de forme de ces appareils aux differents ages de l'insecte. Comptes rendus he bdomadaires des seances et memoires de la Société de biologie, Paris, tome troisieme, huitieme serie, pp. 375–377.

"En resume,la punaise de lit possede depuis son eclosion, *a l'etat de larva et de nymphe. trois glandes, odoriferiques abdominales dorsales* qui disparaissent lors de la derniere mue et sont remplacées, *a l' etat adulte, par un appareil glandulaire metathoracique sternal.* La presénce de cet appareil est un critérium qui permet de démontrer que ce Cimex est arrivé au terme son évolution." p. 377.

1886c. Idem. Recherches sur les glandes odorifiques des insectes hémiptères, et particulièrement sur celles de la punaise de lit. Mécanisme de la secretion. Valeur dans la classification; Association française pour l'advancement des sciences, Congrès de Nancy, XV, pp. 528–532, 2 figs. Separate, Paris, 1886, 5 pp. 2 figs.
Description and anatomy of the odoriferous glands of larva and adult, with illustrations.

1887. Riley, Charles Valentine. Poisonous insects. Reference Handbk. of the Medical Sciences, New York, Edit. I, V, p. 752. Separate, New York, 1887, p. 752.
Brief account, Cf. Osborn (1902).

1893. Butler, Edward Albert. The Bed-bug. Our household insects, London, pp. 273–303, pl. VI, text-figs. 85–101. Knowledge, London, 1890, XIII, V, new series, pp. 209, 225, 251, 275, and cf. Butler (1894). Reviewed, Westminster Budget, Oct. 6, 1893, Westminster Gazette, Oct. 10, 1893.
Good account, including etymology and origin of common and scientific names, anatomy, general description of the stages, remedies, enemies, ancient uses and insects mistaken for; with good figures of adult female and anatomical details.

1896a. Lugger, Otto. The Bed-bug (Acanthia lectularia Linn.) Bull. No. 48, Minnesota Agric. Exp. Station, St. Anthony Park, pp. 222–227, figs. 159–165.
Good popular account; allied species.

1896b. Idem. Second annual Rep. Ent. of the state experiment station of the University of Minnesota, to the governor, for the year 1896. Delano, pp. 196–201, figs. 159–165.
Same as Lugger (1896a).

1896a. Marlatt, Charles Lester. The Bedbug. (*Cimex lectularius* Linn.) Bull. No. 4, new series, U. S. Dep. Agric. Division Ent., Washington, pp. 32–38, figs. 7–9. Revised Edit., 1902.
Very good general account of what is known to date of habits and life history. Number of molts first stated. Excellent figures.

1896. Osborn, Herbert. The common bed-bug. (*Acanthia lectularia* Linn.) Bull. No. 5, new series, U. S. Dep. Agric., Division Ent., Washington, pp. 12, 157–160, 162, 163, figs. 88–89, 92b. Cf. pp. 286–287.
Good history and account, with remedies. Figures nymph, adult, and antennae; compares with descriptions, the more common allied species, quoting Jenyns' (1839) descriptions. Host relation.

1901. Howard, Leland Ossian. Life-history of the bedbug. The Insect Book, New York, pp. 289–290, figs. 178, 179.
Good popular account, with figures of young larva and adult.

1902. Osborn, Herbert. Insects, parasitic. A reference hand-book of the medical sciences, embracing the entire range of scientific and practical medicine, and allied sciences, by various authors. New York, new, revised edit., V, MDCCCCII, pp. 155–156, figs. 2865–2867.
General account; figures copied. cf. Riley (1887).

ERRATA et CORRIGENDA, PART I.

Page 61, 2nd line of title,	*lectularia* read *lectularius.*
Ibidem,	insert parentheses about *Linnaeus.*
71, 3rd. footnote,	*Titkin* read *Tickin*
2nd. paragraph,	insert quotation marks about *bacilli.*
3rd. paragraph,	*contagious* read *infectious.*
72, 3rd. paragraph,	*Cimex* read *Clinocoris.*

Acknowledgements.

The writer wishes to acknowledge the kindness respectively of Dr. L. O. Howard, Chief, and of Miss Mabel Colcord, Librarian, of the Bureau of Entomology, U. S. Department. of Agriculture. Also his indebtedness to Dr. James J. Walsh of New York City, Dr. Edward-Louis Troussart of Paris, Dr. Edward A. Butler of London, and to Mr. George W. Kirkaldy of Honolulu, for past kindnesses in connection with the preparation of this and other papers.

DESCRIPTIONS OF TWO NEW DIPTERA OF THE FAMILY DOLICHOPODIDAE.

BY CHARLES W. JOHNSON.

Leucostola slossonae n. sp.

Face very narrow, linear, whitish, oral portion black, front and vertex green, shining, bristles large; occiput green, with a row of small black bristles above near the orbits and a shorter parallel row behind, the lower half bearing long, silvery, white hairs; antennae black, third joint conical, length about equal to the first and second taken together. Thorax and scutellum a shining metallic green, with long black bristles, the four on the scutellum widely separated; plurae green, covered with a whitish pollen, prostigma yellow. Abdomen green, shining, with short black hairs, base of the second, third, fourth and fifth segments a dark metallic bronze, sides of the second, third and fourth segments, with a spot of whitish pollen at the posterior angle, sixth segment a metallic blue-black, hypopygium dark green, lamellae brown, very long and filiform. Legs yellow, the upper side of the front and tips of the posterior femora, tips of the front and middle tibiae, tips of the posterior metatarsi and the entire tarsi black, coxae greenish, with a thin whitish bloom and white hair on the front and middle pairs, each of the middle coxae bears a prominent black spine, end of the front metatarsi dilated and forming a knob-like projection below. Wings with a slight brownish tinge, tegulae yellow, cilia white, halteres yellow. Length 6.5 mm. Type in the New England collection of the Boston Society of Natural History.

One specimen collected on Mt. Washington, N. H., by Miss Annie T. Slosson, during the summer of 1905. The absence of hairs on the first joint of the antennae and short transverse second joint, bars this species from the genus *Argyra*. On the other hand, the long lamellae, coxal spines, and dilated front metatarsi makes its position under *Leucostola* only tentative, until more material is obtained.

Argyra robusta n. sp.

Face and front black, covered with a dull, grayish pollen, face broad with an irregular transverse ridge, depressed above with a slight tubercle below the base of the antennae, mouth parts projecting considerable below the eyes, the large, broad palpi with a distinct covering of grayish pollen, occiput grayish, the rows of black bristles above prominent, with white hairs below, antennae black, the third joint as broad as long. the first about as long as the second and third taken together. Thorax a purplish bronze, covered with a thin grayish dust forming quite distinct dorsal lines, plurae black with a light gray pollen. Abdomen also purplish bronze, with a thin grayish polen more dense at the base of the segments, giving a banded appearance. Legs yellow, the coxae, base of the femora and tips of the tarsi black, the coxae dusted with a whitish bloom, the hairs black. Wings broad, hyaline with a slight tinge of brown, tegulae yellow, the tip black, with white cilia. Halteres yellow. Length, 5.5 mm. Type in the author's collection.

One specimen from Vaudreuil Co., Quebec, July 10, 1901, collected by Mr. G. Chagnon. I have hesitated for a long time from describing this species from a single ♀, hoping that the ♂ would turn up. It is, however, so very distinct from any of the described forms, that there can be no likely chance of confusion.

Argyra aldrichi Johnson.

Since describing this species (Psyche, X. p. 18, 1904) I have had the opportunity of examining another specimen collected by Dr. W. E. Britton, at New Haven, Connecticut, June 8, 1904.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXV.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Eois rotundopennata Packard. The moths differ a little from Packard's description as noted by me (Proc. U. S. Nat. Mus., Vol. XXVII, p. 902-903, 1904.)

Egg. Elliptical, flattened above and below, sunken concave toward the depressed end, no truncation, the micropylar end full and rounded. Reticulations large, irregularly hexagonal, raised, sharp and smooth, smaller in the indentation. Cell areas reticular shagreened. Dead leaf brown, the whole of the antemicropylar flattening blackish brown, a less prominent shade in the indentation; size .6 x .45 x .35 mm. Laid more or less in rows obliquely overlapping, the brown end down, its color caused by the brown mucilage with which the eggs are glued on.

Stage I. Head rounded, free, dark brownish black, not shining. Body long and slender, curled in S shape, the segments finely annulate, elongated; dark brown; a narrow, straight, distinct white dorsal line, a broader but less distinct substigmatal one; joints ten to thirteen paler and with a white subdorsal line added. Thoracic feet blackish; tubercles small, brown; setae short, capitate, obscure.

Stage II. Head squarish bilobed, the lobes slightly conically produced before, dull brown-black with short, scale-like white setae; width .4 mm. Body small, slender, elongate, finely annulate, subventral ridge narrowly prominent, subdentate by the annulets. Dark vinous brown, almost black. A narrow white dorsal line, traces of a subdorsal one at the ends and a more distinct line on the subventral fold, all dotted by the annulets. In dorsal view the segments are cuneiformly widened posteriorly. Thoracic feet black, abdominal ones brown, the anal pair diluted anteriorly. Tubercles and setæ minute, the latter scale-like.

Stage III. Head highly bilobed, the lobes subconic; brown-black with short white setae; width .6 mm. Body moderately elongate, the segments cuneiform, the posterior edges almost wing-margined on joints five to nine, finely annulate. Dark blackish brown, dorsal line linear, whitish; traces of waved subdorsal; subventer with white streaks on the fold, the lower subventral area nearly black. Skin black, granular; setae short, white, capitate.

Stage IV. Head highly bilobed, the lobes separated by a deep notch but rounded, a strong depression at the apex of clypeus; red brown, mottled and dotted with dark brown; width .9 mm. Body moderate, large for the head, flattened, the segments strongly widened posteriorly, cuneiform in dorsal view, joints eight and nine most widened, the thorax and joints ten to thirteen contracted, all rather finely annulate. Dark blackish brown, slightly variegated in lighter; a pale subdorsal streak on joints ten to thirteen; edge of subventral fold streaked in yellowish white, especially on joints seven, eight, and nine; venter and feet nearly black with a few whitish dots in rows. Skin minutely granular; tubercles obsolete; setae short, pale, swollen, sack-like.

Eggs June 10, a few apparently mature larvae in August, but most of them remained very small and probably normally hibernate. They were fed on *Polygonum*. Larvae from Kaslo, British Columbia.

TWO NEW SPECIES OF TELENOMUS.

BY A. ARSENE GIRAULT, WASHINGTON, D. C.

1. **Telenomus quaintancei** species novem.

Female.—

Shining black; length, 0.60 mm. trochanters, knees, distal tips of tibiae, and tarsi, brownish-yellow; basal and distal joints of tarsi darker, the latter sometimes nearly black.

Head slightly wider than mesothorax, much wider than prothorax, from dorsal aspect twice as wide as thick (cephalo-caudad), shagreened; face to cephalic ocellus glabrous, excepting the portions bordering the inner margins of the eyes which are hairy; head triangulate, cephalic aspect hairy; eyes hairy and very dark red, ocelli inconspicuous, reddish, the lateral ocelli close to, but not touching, the margin of the eye.

Thorax rather stout, slightly longer than abdomen, sculpture similar to that of the head, the dorsum with rather dense whitish pubescence. Mesothorax flattened dorsad, with a deep conspicuous smooth femoral furrow on its side. Scutellum smooth, hairy, striate at outer edges.

Abdomen smooth, polished, first and second segments, at base, strongly, longitudinally striate, the striations of the second segment not present near the lateral margin of that segment; second segment by far the largest, one-third wider than long; hairs sparse, whitish, in lateral rows at incisions; anal segment truncate. Abdomen depressed.

Wings hyaline, venation yellowish, the marginal vein more than half the length of the shaft of the stigmal; postmarginal vein sub-equal in length to the marginal and submarginal veins combined, or slightly shorter. Shaft of the stigma thick.

Antennae 11-jointed, uniformly pubescent, black; scape at basal constriction and at tip, and the tip of the pedicel, pale. Antennae more gradually clavate than usual, the club, however, distinct.

Scape long, subclavate, constricted at basal one-fourth and narrowed somewhat at tip; longer than the four joints following. Pedicel oval, much longer and thicker than the first funicle joint. Funicle joints 1, 2, and 3 moniliform, slightly longer than wide, equal, about half the length of the pedicel; 4, wider. Club 5-jointed, the basal joint somewhat rounded, but much wider and slightly longer than joint 4 of the funicle, wider than the scape, and narrower than joint 2 of the club; club joints 2, 3 and 4 equal, 2 slightly smaller, all nearly twice as large as joint 1 of the club, quadrate; the distal joint, or 5, conic, its base slightly narrower than joint 4 of the club, but wider than the pedicel, and about equal to the pedicel in length, though much stouter. Antennae shorter than the body. From six specimens.

Male.—

The same. Length, 0.68 mm., legs and antennae lighter in color; body more slender. Abdomen oval. Mandibles dark brown, tridentate at tip.

Antennae 12-jointed, filiform, the pubescence stiffer. Scape long, cylindrical, curved, more pale at the tip than in the female, nearly as long as the next five joints combined. Pedicel small, rounded, subcuneate. Joint 1 of the funicle longer than the pedicel by one-half, ovate; funicle joints 2 and 3 sub-equal, oval, twice as long as the pedicel and about one-third longer than the first funicle joint; funicle joints 4 and 1 subequal; joints 5, 6, 7, 8 and 9 of funicle equal, subequal to funicle joint 4, but slightly smaller. Club joint acutely conical, twice longer than the preceding joint, or joint 9 of the funicle. Joints of the funicle very slightly pedicellate. Antennae about equal in length to the body. From ten specimens.

Sixteen specimens; ten males, six females.

Female very near to *Telenomus graptae* Howard, female, but the males of the two species are quite distinct. In the female of *quaintancei,* the legs are much darker than those of *graptae,* and the antennae are wholly black, and have a much better defined club. The male differs from the male of *graptae,* by having black antennae and legs, and in the relative lengths of the club and joint 2 of the funicle.

Bred from the eggs of *Sanninoidea exitiosa* Say, on peach, Odenton, Maryland, September 1st to 8th, 1905, in connection with Deciduous Fruit-insect Investigations, Bureau of Entomology, U. S. Department of Agriculture. Apparently common.

The species is respectfully dedicated to Professor A. L. Quaintance.

Type:—No. 9098, United States National Museum.

2. **Telenomus perplexus** species novem.

Female.—

Shining black, length, 1.18 mm.; legs, excepting anterior coxae, yellowish brown; pedicel concolorous with scape, darker basally.

Head slightly wider than thorax, polished, shagreened along the inner margins of the eyes and on vertex. Eyes and ocelli normal, the former naked.

Thorax slightly longer than the abdomen; mesothorax minutely punctate, pubescent.

Abdomen short, subcuneate (dorsal aspect), the anal segment truncate; the second segment slightly longer than wide; first and second segments, at base, strongly, longitudinally striate; remaining segments polished. Wings hyaline, venation pale yellowish.

Antennae 11-jointed. Scape long, longer than the next three joints combined. Pedicel equal to, or slightly shorter than, the first funicle joint, but thicker; ovate. Joint 1 of funicle cylindrical, much longer than the following joints, twice the length of joint 3 of the funicle; funicle joints 2, 3 and 4 subequal, 3 and 4 equal, 2 slightly longer, all moniliform. Club 5-jointed, its basal joint transverse, about equal in length to joint 4 of the funicle, or slightly longer; club joints 2, 3 and 4 subequal, varying slightly in width, 3 the widest, all much wider than the other antennal joints; the distal antennal joint, or club joint 5, conic, acute, about as long as each of the three preceding joints of the club.

From two specimens.

Male.—

The same. Length, 1.15 mm. Antennae 12-jointed. Scape paler yellow; antennal joints 2, 3 and 4 with some yellow.

Scape short, about as long as pedicel and first funicle joint combined. Pedicel short, subcuneate, about half the length of the first funicle joint. The latter cylindrical, equal to, or slightly longer than, joint 2 of the funicle; funicle joint 3 thicker and shorter; funicle joints 4, 5, 6, 7, 8 and 9 moniliform, equal, much shorter than joint 3 of funicle, and less than half as long as funicle joint. 1. The club pointed cylindrical, nearly twice longer than the joints immediately preceding, and about equal to joint 3 of the funicle in length.

From one specimen.

Three specimens; 1 male, 2 females.

Bred from the eggs of *Brochymena* species on Currant, received from Miss May Beattie, Zanesville, Ohio, July 20th, 1905, in connection with Deciduous Fruit-insect Investigations, Bureau of Entomology, United States Department of Agriculture.

Type:—No. 9039, United States National Museum.

To replace corresponding pages in April-June number.

NEW LEPIDOPTERA FROM VENEZUELA.

BY ANDREW GRAY WEEKS, BOSTON, MASS.

Carystus Ambrosei sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head and palpi above black, below tawny. Thorax above black, below black with gray hairs. Abdomen above black, below brown with a white dash at thorax junction. Antennae black. Club black above, below tawny. Legs black near body, turning to tawny toward tips.

Upper side of fore wing black. Near apex, in subcostal area, is a small white dot. Below this, skipping one interspace, is a series of five interspacial white spots running downwards towards centre of inner margin, the first two small, the third very large, the fourth small and fifth a small dot in lowest submedian interspace.

Upper side of hind wing black. A broad and very prominent white band runs from centre of inner margin towards upper angle, extending across one-half the wing only, stopping near end of discoidal space. Inner margin slightly dusted with gray scales.

Marginal fringes of ground color, turning to white at anal angle.

Under side of fore wing the same as upper surface except that the spots are more closely connected and the ground color is brownish.

Under side of hind wing the same as upper surface except that the prominent band extends completely across the wing from a point near the upper angle on costa to centre of inner margin and of unvarying width. This band is creamy white.

Variations: My small series of specimens shows no variations except that the two small subcostal spots are sometimes wanting and the lowest dot, also, on fore wing.

This species was not found in collections here, nor in the Godman collection, British Museum, etc.

Taken in January, 1900.

Pamphila verdanta sp. nov.

Habitat: Suapure, Venezuela. Expanse 1.15 inches.

Head, thorax and abdomen above, dark brown with hairs of a greenish tinge: below, greenish with white hairs. Antennae, black. Club above black, below tawny. Legs greenish at base, tawny towards tip.

Upper side of fore wing dark brown. Immediate basal area dark tawny, the nervures and nervules showing distinctly black. Costa dark tawny nearly to apex. In apical area are three subcostal tawny spots, and below these, two more somewhat nearer hind margin. Below these last two is a series of three large interspacial tawny spots extending downwards towards centre of inner margin, but stopping at lower submedian nervule. The lowest of these three spots is well concaved on hind marginal side. Hind marginal fringe tawny.

Upper side of hind wing dark brown. Across the centre of the wing is a broad band of tawny, starting near upper angle and stopping near central portion of inner margin. The basal area has some tawny hairs. Hind marginal fringe tawny.

The costal area of lower side of fore wing is a tawny green, also the apical area, extending downwards to a point at lower angle. The inner marginal area up to discoidal space is nearly black. The band of lighter spots of upper surface is distinctly repeated with slight dashes of similar shade in hind marginal interspaces.

Under side of hind wing tawny green. Close to juncture with thorax is a white spot. The band of upper surface is repeated but is pure white and extends nearer or fully to the costa just above angle. Hind marginal interspaces dashed with tawny suffusing upwards somewhat near anal angle. The anal angle is dusted with dark brown scales.

Taken in March, 1900.

Pamphila mengeli sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.10 inches.

Head, thorax, abdomen and antennae dark brown above, nearly white beneath. Club above dark brown, beneath dark brown tipped with brick color. Legs nearly white.

Upper side of fore wing dark brown. Basal area slightly dusted with golden scales. Near the apex are two subcostal white dots, very minute. Below these in first submedian interspace near end of discoidal space is a larger white dot, and below it in next lower interspace, are two white dots in a line parallel to hind margin. A black dash extends downwards towards centre of inner margin from the end of discoidal space. Marginal fringe very light brown.

Upper side of hind wing dark brown. A series of four indistinct interspacial white spots extend from near upper angle across the wing towards anal angle. Marginal fringe very light brown.

Under side of fore wing light brown, the lower half, especially towards the base, dark brown. The white dots of upper surface are repeated, the two lower ones more prominent, and in interspace below these is a dusting of light scales. Marginal fringe of ground color. Tips of nervules and nervures touched with black. Nervures and nervules of lighter color than ground color.

Under side of hind wing light brown. The nervures and nervules distinctly lighter. The light spots of upper surface are joined, forming a line rather than a series of spots and extending upwards nearer to costa. Within this line and at centre of wing area is a light dot of similar color. The marginal fringe and border is the same as on fore wing.

This species was found in the Godman collection unnamed, but was not in the British Museum or other large collections.

Taken in November, 1899.

Pamphila winslowi sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.15 inches.

Head, thorax and abdomen above, tawny with a greenish tinge; below, nearly white. Antennae black. Club black above, below bright tawny with brown towards tip. Legs bright tawny.

Upper side of fore wing dark brown. The entire basal area is bright tawny, extending along costa to near apex, and also along inner margin to near hind margin. The brown ground color juts inwards towards base at end of discoidal space and also in the two lower submedian interspaces. A black dash crosses the wing from end of discoidal space downwards to lower submedian nervule. At central point of the wing the bright tawny is golden color. The coloring is the same as in many species of pamphila, such as P. mystic Scudd., P. brettus Boisd., P. sylvanus Esp. and many others.

Upper side of hind wing dark brown. Discoidal space bright tawny suffusing into interspace towards hind margin and also into the next upper and next lower interspaces. The entire inner marginal area is dusted with golden scales and hairs.

The hind margins of both wings have a dark thread and a fringe of tawny, darker on fore wing than on hind wing.

Under side of fore wing bright tawny. The tawny markings of upper surface show in a somewhat lighter shade. The basal area below costa is nearly black and below it the inner marginal area is mouse color. Hind margin edged with a dark brown thread. Fringe slightly darker than ground color.

Under side of hind wing very bright tawny approaching a golden yellow. The tawny markings of upper surface are barely noticeable. Towards anal angle, the ground color darkens in a slight degree. Hind margin edged with a dark brown thread. Fringe slightly darker than ground color.

Taken in November and December, 1899.

Erycides nakawara sp. nov.

Habitat: Suapure, Venezuela. Expanse: 2.25 inches.

Head above, black with blue dots encircling the eyes and three thread-like lines of blue crossing from eye to eye; below white. Antennae black. Thorax above, black with four bands of blue running parallel to one another from shoulder to abdomen; below, black with white bands. Abdomen above, nearly white with a black band running down its centre from thorax to tip, circled with black at base of each segment; below, black with four white bands parallel to one another running from thorax to tip. Upper joints of legs blue, lower joints black.

Upper side of fore wing black. Immediate basal area brilliant blue. Nervures and nervules black. Beyond this a broad black band heavily dashed with blue in two lower interspaces. Running across the wing diagonally from costa nearly to lower angle is a broad band of semitransparent white. Between this and apex, well below the costa, is a similar white band covering two interspaces only. In the apical area is a patch of similar size with a white dot on costa. Well within the hind margin is a line of blue scalings running from rear apex to lower angle.

Upper side of hind wing black. From the base run three prominent blue dashes, the lower one following close to inner margin and extending nearly to anal angle, the next covering the discoidal space and a little beyond, the third one runs parallel to these and is of similar extent. The first and third are covered with white or very light blue hairs, the central or second one having scaling only. The hind margin is well dentated towards anal angle, the interspaces touched with white. Well within it is a line of blue scalings well broken by the nervules, a continuation of the same markings of fore wing. Near upper angle betwixt this line and the outer one of the three prominent dashes, is a dash of blue scales, starting well below the costa and running a quarter inch downwards towards anal angle.

Under side of fore wing black but not as rich as upper surface. General markings the same. Basal blue area of upper surface is represented only by blue at base of costa and a blue diagonal dash beyond. The inner marginal area is dark mouse color except towards lower angle. The dashes of blue noted in the two lower interspaces of upper surface are wanting.

Under side of hind wing black. The appearance of the wing is quite different from upper surface as the prominent dashes of brilliant blue are quite altered. There are three bands, one starting at costa at base and extending downwards until by a slight inward curve it strikes lowest submedian nervule about midway to lower angle; the next band runs downwards from costa, practically the same in area and extent as the first, ending at centre of wing area at the end of discoidal space; the third band represents the hind marginal blue line of upper surface, but is much more prominent. Inner margin edged with brilliant blue.

This species is very close to E. distans Herr. Schaff. and also E. pygmaleon Hew. The group is open to much interesting future work for those who locate in its region.

Thymele pervivax Hubn., var. nov. **aleanderi.**

Habitat: Suapure, Venezuela. Expanse: 1.75 inches.

Head and thorax above brilliant green; below, brilliant green with some brown and white hairs. Abdomen above, dark brown; below light brown. Antennae, black. Legs above, dark brown; below, lighter with greenish hairs near body.

Upper side of fore wing, a rich dark brown. The basal area is heavily dusted with brilliant green scales. Fringe of hind margin becomes whitish towards lower angle.

Upper side of hind wing the same.

Under side of fore wing dark brown with golden lustre. Basal area dusted with lustrous green scales as on upper surface. Inner marginal area very light brown.

Under side of hind wing the same as upper surface. Taken in January, 1900. This is practically indentical with T. pervivax, Hubn. excepting that pervivax has a very prominent semitransparent band crossing the fore wing. The specimens in hand show no indication of such a band except in one instance where I noticed a slight dot. It would be unsafe to create a new species and the advisability of naming a variety is doubtful. There is a specimen in the Godman collection un-named.

Thanaos parkeri sp. nov.

Habitat: Suapure, Venezuela. Expanse: 1.60 inches.

Head, thorax and abdomen above, very dark brown. Antennae black with white annulations at base of each joint. Club black above; tawny brown beneath, and approaching white towards base. Legs nearly black.

Upper side of fore wing very dark brown with slight grayish dustings. Near the base is a slight suggestion of gray dusting running from costa towards inner margin scarcely perceptible. The interspaces beyond, in centre of wing and the centre of discoidal space show a slight gray dusting. Outside of this in a line from costa downwards to lower submedian nervule, is a slightly prominent irregular band of gray dusting, broad at costa but diminishing and disappearing towards lower submedian nervule. In apical area outside of this band are four subcostal semitransparent white dots. Hind margin edged with a dark thread, and the hind marginal area has a series of interspacial grayish dashes from costa down to inner margin, well within the margin, and hardly noticeable.

Upper side of hind wing dark brown. The only marking is a suggestion of light brown dashes in interspaces running from upper angle to a point just above anal angle on inner margin. Hind margin edged with a dark thread. Fringe is generous and near upper angle is edged with white.

Under side of fore wing dead dark brown. The gray dustings of upper surface do not show. The series of interspacial dashes or dustings within the hind margin are fairly prominent. The subcostal white dots are repeated. The hind margin has a dark thread and the fringe shows light hairs in interspaces.

Under side of hind wing dead dark brown. The line of interspacial light dashes of upper surface, running from upper angle downward are repeated and more clearly defined.

This species is closely allied to N. tatius Edw., N. juvenalis Fabr. and that group, and a detailed and identifiable description is almost impossible. One specimen was found unnamed in the Godman collection; also one specimen unnamed in the British Museum, taken in Malto Grosso, Brazil.

Taken in December, 1900.

Nisoniades plummertini sp. nov.

Habitat; Suapure, Venezuela. Expanse .95 inch.

Head, antennae, thorax, abdomen and legs above, very dark brown; below, lighter brown.

Upper side of fore wing dark brown. Across centre of wing from centre of costa a darker band runs downwards through discoidal space to inner margin. A similar band, but slightly broader, starts from costa and runs down to inner margin at a point near lower angle, following the contour of hind margin. On the inner edge of this band are four subcostal white dots and two more below them in the first and second submedian interspaces. There is a very slight dot also at the end of the discoidal space. The interspaces at edge of hind margin are slightly darker than ground color.

Upper side of hind wing the same as fore wing, the bands being continued to inner margin. The dots are, however, wanting.

Under side of fore wing the same as upper surface except that color is lighter and deader.

Under side of hind wing the same as upper surface except that color is lighter and deader.

Taken in November, 1900.

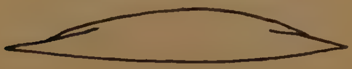
A specimen was found in the Godman collection unnamed. It is very close to N. hayhursti Edw.

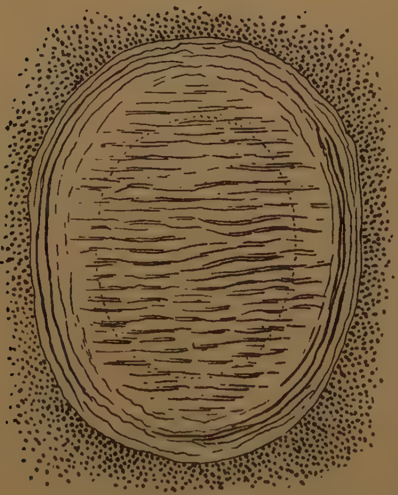
COCOONS AND YOUNG OF CONIOPTERYX VICINA.

BY J. H. EMERTON, BOSTON, MASS.

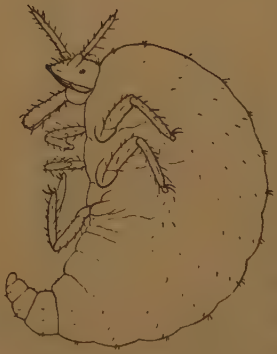
While hunting for spiders under leaves on the ground at Allston, a suburb of Boston, in November, I found the cocoons of this neuropterons insect attached to oak leaves and resembling the egg cocoons of small spiders like Micaria and Castaneira. The cocoons were white and had fine parallel wrinkles across the upper surface, in this differing from spider cocoons, which are usually smooth. In nearly every case the cocoons were on small broken pieces of leaves of last season's growth. The under side of the cocoon is thin and attached to the leaf by its whole surface. The upper side is formed by a flat ring sometimes thickened on the inner edge and a transversely wrinkled cover which is not attached to the inner edge of the ring but beyond it near the outer border of the cocoon, as shown in the section. The mature insect tears a hole

CROSS SECTION OF COCOON

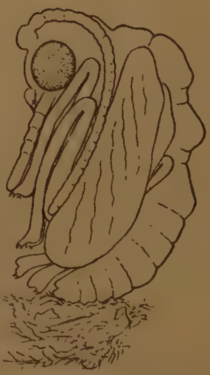




COCOON ATTACHED TO BARK



Winter larva as taken from cocoon



Pupa with larva skin adhering to lower end.

in the upper side large enough to crawl through, and leaves the pupa skin half way out.

The larva is flattened sidewise like an amphipod crustacean and lies on its side in the cocoon. It is motionless when removed, even after several days in a warm room. It resembles closely the larva of *C. psociformis* Curtis described and figured by Schlectendal in the proceedings of the Verein fur Naturkunde of Zwickau, Saxony, in 1881. The head resembles it closely and the mandibles are short and pointed as in psociformis, but the antennae and legs are much shorter than in that species. The whole body is roughened with fine rounded elevations and each segment is crossed by a single row of short hairs.

Schlectendal found his larvæ in winter under loose bark of oak trees at Halle in cocoons resembling those of spiders and was as much astonished as I was at the discovery. He, however, concluded that the cocoons were really those of spiders and that the larvae had eaten the eggs. The cocoons differ in structure from any spider cocoons with which I am acquainted and it seems more probable that they are made by the larvae themselves when about to hibernate.

A larva in a cocoon found November 9 and kept in the house in a tight bottle matured and came out of the cocoon January 30. Cocoons collected January 31 and then containing larvæ had pupae in them March 1, and the mature insects came out March 12 to April 1.

THE MAXILLA IN RHYNCHOPHOROUS COLEOPTERA.

To the Editor of Psyche:

In Vol. XI. of Psyche, in the paper by Miss McClenahan on the development of the rostrum in Rynchophorus Coleoptera, there is used a nomenclature of parts of the maxilla that is probably in part incorrect. As I am responsible for this usage, I wish to make this explanation. Miss McClenahan's study was a developmental one and did not concern itself with the tips of the maxilla. Her time was limited to the very little that is available for work on an undergraduate thesis. I was busy with other investigations, and when the need of names for these maxillary sclerites arose, I told her to follow some authority, and to concentrate her study upon the developmental problem. The papers she used were mostly borrowed, and I do not now remember the source of the nomenclature copied. Since her paper was published both Miss McClenahan and myself have received a number of letters, making inquiry as to the reasons for her apparent interpretation of homologies. Looking into the matter now, it appears that what is called the galea of the maxilla in her paper, should be called the palpus; the galea having disappeared through fusion with the lacinia in the Ryncophorous Coleoptera, although still preserved separately in some other coleopterous larvae. In this conclusion Miss McClenahan now concurs.

James G. Needham.

A NOTE FROM STANFORD UNIVERSITY.

The entomological collections and laboratories at Stanford University suffered practically no injury from the recent earthquake in California. The Stanford buildings which were wrecked were the great Memorial arch, the famous church, and three large new buildings in course of erection (library, gymnasium and museum). University work will begin again on August 23, the regular date for the opening of the next college year.

(Signed) Vernon L. Kellogg.

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148. Bulletin, American Museum of Natural History, N. Y. City.
207. Seventh report N. Y. State Forest, Fish and Game Commission, Albany.
208. Bulletin, Maine Department of Agriculture, Augusta.

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A REVIEW OF THE NORTH AMERICAN SPECIES OF NOTIOPHILUS.

BY H. C. FALL, PASADENA, CAL.

Mr. Hayward's recent article (Psyche, Oct., 1905) on the secondary sexual characters of Notiophilus, recalls a short study of this genus made by the writer some seven or eight years ago, which, having progressed to the point of preparing a preliminary table of species, was dropped for other work. Since the publication of Mr. Hayward's note, the old data have been resurrected, some further investigation made, and the results are offered as of possible interest to students of our Coleoptera.

In completing the present review I have been very greatly aided by Mr. Frederick Blanchard, who has not only made a most thorough study of the Le Conte Collection, fixing the status of the earlier types of this author, but also an examination of the collections of Melsheimer, Harris and Ziegler, where were found undoubtedly authentic exponents of Say's *semistriatus*, a species which Le Conte himself failed to properly interpret. The results of Mr. Blanchard's observations are embodied in the synonymy which follows, and to him belongs almost the entire credit for this very considerable portion of the work. While no effort has been made to obtain material from many sources, special series have been sent by Messrs. Leng, Wickham, Knaus and Blaisdell, to all of whom my sincere thanks are due.

The genus Notiophilus is widely dispersed throughout the North Temperate Zone and occurs in almost every portion of our territory, though evincing a somewhat marked preference for hilly and mountainous regions. Although of small size, the peculiar and pleasing form and sculpture of these insects has made them favorites with collectors, yet it is a fact that aside from *aeneus*, *semiopacus* and perhaps *sylvaticus*,—all strongly marked forms— our native Notiophili are sure to be found more or less confused in nearly all collections.

At the time of my original investigation it was noted that in all species of the genus the males have one setigerous puncture each side and the females two;* but I do not recall having observed the dilation of the middle tarsi in the males of certain species to which Mr. Hayward alludes, and which was originally announced by C. G. Thomson.† This modification is at best very feeble, and in view of its gradational character, quite too slight to be used for specific separation. To illustrate: Hayward divides our species into two groups, the first containing *sylvaticus, aquaticus, hardyi* (=*aquaticus*) and *nitens,* in all of which the basal joint of the middle tarsi is dilated; the second containing *aeneus, semiopacus, semistriatus* (=*novemstriatus*) and sibiricus (*semistriatus*) ‡ having this joint "simple as in the females." This division is quite correct, and when we compare the opposite extremes—*sylvaticus* and *aeneus*—the difference is very obvious, but if we compare the adjacent extremes of the two series—say *nitens* and *novemstriatus*—the difference is so slight that a trifling individual variation might easily reverse their positions. Wherever there is any dilation of the basal joint of the middle tarsus, there is a similar and better marked modification of the front tarsus; in fact, with the possible exception of *aeneus,* where it is scarcely detectable, the males of all species have the first three joints a little dilated or more triangular in form than in the female, the difference being relatively slight in the species of Hayward's second group. In all species of the genus, without exception, the first three joints of the front tarsi are more or less squamose beneath in the male, as is also the basal, and sometimes the second joint of the middle tarsi; the squamules here being present in the apical half or less of the joints in those species with the first joint undilated. In the reference above quoted, Thomson describes as new *bigeminus,* and states that it differs from the common European species—*aquaticus, palustris* and *biguttatus*—in its simple non-spongiose middle tarsi of the male, and in the securiform last joint of the labial palpi, especially in the male. The entire correctness of Thomson's statement may, I think, fairly be questioned, as I much doubt if there is any species of Notiophilus in which the middle tarsi are normally absolutely

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*This character fails in rare instances. I have seen a male *semistriatus* with two anal punctures, and a female of *aquaticus* with only one puncture each side.

† Bull. Ent. Soc. France, 1883, p. CXII.

‡ *Obscurus* Fall was omitted by Mr. Hayward, being unknown to him; it is virtually the same as *nitens* in this respect. The parentheses are mine.

devoid of squamules. Mr. Blanchard has recently observed (*in litt*) that the palpi are more or less dilated in the males of certain of our species. An examination shows that this is true of all our species, the dilation being as a rule slight, but in *semistriatus* quite strongly marked, and sufficient to at once separate this species from all others in our fauna.

Of the not very numerous characters useful in distinguishing our species, it may be well to briefly discuss two or three of the more important before using them in the following table. In all of the species the front is broadly longitudinally grooved at the sides, the intervening space being marked with narrower grooves or striae which differ in number and fineness in such a fashion as to enable us to divide our species into three groups. The striae are not infrequently more or less irregular, so that the exact number is not always easy to determine, but with a very little experience there is rarely any difficulty in determining to which group a given specimen belongs.

These three sections may be termed from the number of frontal striae the 5-striate, 7-striate, and 12-striate groups. Of these the 5-striate series is much the most numerous, containing eight of the eleven North American forms, including all that are found east of the Mississippi River, or for that matter east of the Rocky Mountains, if we except a form of *nitens* occurring in Texas. To the second group belong *nitens* and *obscurus,* two closely allied species, which are intermediate between the first and third groups in other characters besides the number of frontal striae. To the 12-striate group belongs only *semiopacus.* The striae here are very fine and seem to vary in number from eleven to thirteen.

Another character which I have found to be remarkably constant is the number of annulate setigerous punctures ("foveae") near the apex of the elytra. This character is an especially useful one, inasmuch as it permits of separating at once and with certainty, forms which are without careful attention easily confused. In all the species there is a setigerous puncture near the apex and just within the deeply impressed apical portion of the seventh stria. In the greater number of species there is also a second puncture immediately in front of this, and distant from it as a rule somewhat less than its distance from the suture, but in three species—*semistriatus, aquaticus* and *borealis*—the apical puncture alone is present. The other characters used in the following table are sufficiently clear or will be made so in the remarks under the various species.

In several instances our species are mutually very closely related, depending for their specific standing on an assemblage of minor characters which, while probably quite sufficient for their establishment, render their tabulation somewhat unsatisfactory because of their gradational nature. Absolute characters are present only in the two extremes of our series—*aeneus* and *semiopacus*.

TABLE OF SPECIES.

Front 5-striate between the broad lateral grooves.

Legs and antennae entirely pale; head much wider than the prothorax, the sides of the latter deeply sinuate posteriorly....................1 *aeneus*.

(Legs dark or with the tibiae alone paler, antennae pale at base only.)

Elytra each with one apical annulate puncture.

Form generally stouter, sides of prothorax more strongly sinuate behind; elytral striae complete, the inner ones, however, faintly impressed at apex; tibiae more or less pale; last two joints of maxillary and terminal joint of labial palpi dark, the latter quite broadly dilated and truncate in the male..2 *semistriatus*.

Form less stout, sides of prothorax less sinuate behind, inner elytral striae nearly or quite effaced at apex; palpi dark except at extreme base, the terminal joint of the labial palpi but slightly modified in the male.

Less elongate, prothorax more transverse, elytra parallel, more strongly punctured and less bronzed, tibiae usually dark, sometimes pale..3 *aquaticus*.

More elongate, prothorax less transverse, elytra a little narrowed anteriorly; less strongly punctured and more bronzed; tibiae always dark...4 *borealis*.

Elytra each with two apical annulate punctures.

Elytra usually entirely black bronzed, rarely with pale apical stripe.

Second discal stria of the elytra more remote from the fifth than from the sutural stria, striae becoming rapidly obsolete behind the middle; tibiae dark..5 *simulator*.

Second discal stria of the elytra less remote from the fifth than from the sutural stria; striae less fine and in part entire; tibiae paler..6 *novemstriatus*.

Elytra with a broad and entire yellow lateral vitta occupying the lateral interstriae.

Form more elongate, prothorax less transverse and more narrowed behind..7 *nemoralis.*

Form less elongate, prothorax more transverse, sides straighter and less convergent behind.............................8 *sylvaticus.*

Front 7-striate.

Prothorax rather strongly narrowed posteriorly, interstriae of elytra feebly or scarcely alutaceous, a single dorsal puncture.....9 *obscurus.*

Prothorax less narrowed posteriorly, interstriae of elytra distinctly alutaceous, dorsal punctures usually two in number.......10 *nitens.*

Front about 12-striate; lateral interstriae and sutural interspace opaque, dorsal punctures usually three, rarely two or four...............11 *semiopacus.*

1. *N. aeneus* Hbst.

Very distinct from all our remaining species and at once recognizable by the pale legs and antennae. It represents an entreme among our species in its larger head, stouter antennae, deeply sinuate sides, prominent hind angles and broadly impunctate disk of the prothorax, and in the less unequal elytral interspaces, thereby approaching the usual type of striation in the Carabidae. The labrum is here distinctly emarginate at apex, but scarcely at all so in our other species. The dilation of the male tarsi is at a minimum, being scarcely detectable, and the squamules of the middle tarsi are few in number.

Aeneus is a common species in the Northern States and Canada from New England to Lake Superior and Illinois, and extends as far south as North Carolina. (Blanchard).

2. *N. semistriatus* Say.

In its rather strongly narrowed and sinuate sides of the prothorax, and the relatively narrow second elytral interspace, this species approaches *aeneus* more closely than does any other, and forms a natural transition to those which follow. It is, as a rule, a little more robust than *aeneus,* and differs from it and all other species of the 5-striate group except *sylvaticus* and *nemoralis* in its more distinctly impressed and more complete elytral striae, which though fine are all quite evident at apex. In color it is black, moderately bronzed, surface polished throughout, basal four joints of antennae, and tibiae in great part, pale. Terminal joint of palpi (especially the labial) quite strongly dilated and truncate. I have seen several examples in which the discal annulate puncture of the elytra is wanting, a condition not yet observed in any other species.

Semistriatus is widely dispersed, occurring from New England to New Mexico. The following localities are known to me: Massachusetts; Staten Island, New York (Leng.); Pennsylvania; New Jersey; North Carolina; Ohio; Illinois; Iowa; Ottawa; Canada; Manitoba; Kansas; Veta Pass, Colorado (Schwarz); Breckinridge, Col., 9600-10,000 feet (Wickham); New Mexico (Snow); Cloudcroft, New Mexico (Knaus.)

The species here regarded as *semistriatus* agrees well in size and general character with Say's description, and is the one so understood by Harris, Melsheimer and Ziegler. Moreover it is the only species with which Say could have confused his *porrectus* (*aeneus* Hbst.), which he originally described as "var B" of *semistriatus*. The *semistriatus* of Le Conte and Crotch was Le Conte's *novemstriatus*, a much smaller and very different looking species which is common in the eastern United States. The true *semistriatus* was described as *confusus* by Le Conte, who afterward wrongly placed it as a synonym of the East Siberian *sibiricus*, with which he also confused his own *punctatus*.

3. *N. aquaticus* Linn.

Very similar to *semistriatus*, and as a rule a little smaller and less robust, though frequently not at all so. The prothorax is a little less narrowed behind, the sides less strongly sinuate, the elytral striae less impressed and less coarsely punctured than in *semistriatus*; the discal striae are moreover almost completely effaced at apex, while they are more or less distinctly traceable in *semistriatus*. The tibiae are entirely dark in the great majority of specimens but are occasionally more or less pale, and the elytra have rarely a more or less distinct pale apical vitta. The terminal joints of palpi are perhaps a little more evidently dilated in the male than usual, but the dilation never approaches in degree that exhibited by males of *semistriatus*. *Aquaticus* is also nearly related to *borealis* and *simulator*, the former separable however by its more elongate form, and the latter by the two apical annulate apical punctures of the elytra. Further differences will be given under these species.

After a very careful study of available material and of the literature of the subject, there seems to be no other course than to unite *punctatus* Lec. and *hardyi* Putz. with *aquaticus* Linn., which occurs commonly throughout Europe and Northern Asia. The *punctatus* of Le Conte was described from Lake Superior. In the types, and also in a series from Hudson's Bay Territory in the Le Conte collection, the tibiae are reddish and the elytra have a pale apical vitta, but on comparison with a typical Newfoundland specimen of *hardyi,* sent to Le-Conte by Putzeys, Mr. Blanchard assures me that he has not the slightest doubt of their identity. This most obvious variation in the specimens in our fauna, viz—the color of the tibiae and elytral apex, are noted by Putzeys in his description of *hardyi,* and are exactly paralleled in European specimens of *aquaticus*; in fact the described variations of *aquaticus* in Europe are much greater than that existing between a series sent me by Reitter, and our native specimens.

Kirby many years ago recorded *aquaticus* from British America, and Sahlberg has more recently thus identified a specimen from the Alaskan coast of Behring Strait. Le Conte pronounced Kirby's reference erroneous, but there is ample reason for saying that the correctness of Le Conte's views in this genus is not above suspicion. The introduction of *aquaticus* into the supplement of the Henshaw list is based on Sahlberg's record, which may have been correct, though I suspect that the species in question was really *borealis,* a species which is closely related to *aquaticus,* and which is known to me from Alaska.

In our fauna *aquaticus* is known to range from Labrador through northern New England and Canada to Lake Superior, Hudson Bay, Manitoba, Montana, and in the higher parts of the Rocky mountains as far south as New Mexico. It is thus seen to be a distinctly more northern species than *semistriatus,* which occupies the intervening territory to the south. Its occurrence at Tyngsboro in northeastern Massachusetts and only a few hundred feet above sea level is quite exceptional according to Mr. Blanchard, who says—"In February, 1870, about fifty specimens of *N. aquaticus* were picked up from a frozen temporary pool in a grassy field; some were partly frozen into the ice, others were crawling about on the surface. Of these I have only three ♀'s left, all others having been distributed as *hardyi,* and none have since been taken here."

The following specific localities are known to me: Labrador (Strait of Belle Isle—Sherman); Newfoundland (*hardyi* in Le-Conte Coll., Bay of Islands—Leng.); New Hampshire (Mt. Washington and Pack Monadnock—Blanchard); Massachusetts (Tyngsboro and summit of Mt. Watatic—Blanchard); Wisconsin (Bayfield—Wickham); Lake Superior and Hudson Bay Territory (Le Conte Coll.); Montana (Kalispell—Wickham and the writer); Colorado (Argentine Pass and Veta Pass—Schwarz, Mountains southwest of Montrose, 9-10,000 feet, Cochelopa Pass, Durango 5500-7000 feet—Hayward); New Mexico (Beulah—8,000 feet, Las Vegas Range—11,000 feet—Cockerell).

4. *N. borealis* Harris.

Very closely allied to the preceding species, the chief differences being as follows: The color is more brightly bronzed than in our native specimens of *aquaticus*, the general form more elongate, the prothorax distinctly less transverse and slightly more narrowed posteriorly, the elytra more elongate and more oval, widest behind the middle, narrowing a little anteriorly, the humeri in consequence less strongly rounded; elytral striae a little more finely punctate and as a rule less completely effaced at apex. The tibiae are apparently always dark; the basal joint of the antennae, except very rarely, is entirely dark; joints 2-4 pale beneath, usually dark above, but sometimes only slightly so. In *aquaticus* the first four joints are pale beneath.

This species is the most truly boreal or alpine in distribution of any in our fauna. It has been taken by Mr. Blanchard on or near the treeless summits of Mts. Washington and Lafayette in the White Mountains of New Hampshire, and by Mr. Leng on Mt. Marcy, the highest peak of the Adirondacks, the beetles being obtained, writes Mr. Leng, "by sifting the mosses that flourish in sheltered places among the otherwise bare rocks of the summit." Specimens closely in accord with these have been sent me by Dr. Blaisdell, who took them at Nome, Alaska. I have, under *aquaticus*, expressed the suspicion that the Alaskan specimens recorded by Sahlberg as *aquaticus* were really the present species.

The name *borealis* is adopted from the Harris Correspondence, published by Scudder in 1869. It was used by Dr. Harris in a letter to Dr. LeConte (Jan. 23, 1849) for a specimen taken in the White Mountains by Mr. Tuckerman. Mr. Blanchard writes that "this species is at present represented in the Harris collection by a single female specimen without name, numbered 1680, and referred to by number only in the Ms. catalogue as having been collected by Mr. Tuckerman at the White Mountains in 1838. The specimen now bears the label *hardyi*," which has of course, been attached comparatively recently. There can be no doubt whatever that this specimen is the true *borealis* of the "Correspondence," and though the brief allusions therein do not fairly constitute a description, still, as no subsequent description has been written and no synonymy is involved, I have chosen to quote Harris as the author of the species.

5. *N. simulator*. n. sp.

This species greatly resembles *aquaticus* but is always separable by the two apical annulate punctures. In addition, the size is a little smaller, the elytral striae decidedly finer, becoming effaced at a greater distance from the apex, the dorsal puncture a little more basal in position; the sides of the prothorax a little straighter and very feebly sinuate posteriorly. The palpi and antennae are colored as in *aquaticus;* the tibiae are black in all specimens seen.

Length 4.4—4.65 mm.

Four specimens, all ♀'s, have been sent by Mr. Wickham. They bear labels as follows: Mullan, Montana; Leavenworth Valley and Silver Plume, 9000-11000 feet, Colorado; Houston, Texas. There is a specimen, also a ♀, in Dr. Blaisdell's collection from Coeur d'Alene, Idaho, probably also collected by Wickham.

Simulator is the nearest approach in our fauna to the Siberian *sibiricus* of which there is a specimen in the LeConte collection labeled "Ajan," and sent by Motschulsky himself. This specimen, writes Mr. Blanchard, "is a little larger than *simulator,* prothorax a little more narrowed at base and sinuate each side behind, the elytra with humeri more arcuate each side to meet the narrowed prothorax, elytral striae more produced behind and more coarsely punctate except at base, the elytra apparently a little more elongate." These differences, it will be seen, are precisely those which separate *simulator* from *aquaticus,* and were it not for the two apical punctures in *sibiricus* it could not possibly be separated from *aquaticus.*

6. *N. novemstriatus* Lec.

Our smallest species, and withal the commonest in the eastern United States. It is easily recognized by its small size, rather strongly bronzed surface lustre, very broad second elytral interspace and consequent crowding of the lateral striae, and two apical annulate punctures. The inner ones of the lateral striae are more or less completely obliterated before the apex, the apical portion of the first of these (the second stria) however, remaining as a short isolated furrow. Two or three of the striae before the deeply impressed seventh are always nearly or quite entire. The four basal joints of the antennae, and the tibiae, are always pale, the palpi dark except at base. There is occasionally a pale apical elytral vitta, more often seen in specimens from the Southern States. In all the preceding species the surface of the elytra is polished throughout, there being only the faintest indication of alutaceous sculpture at the extreme apex. In the present species the apex is always distinctly alutaceous for a short distance, and this sculpture exists in all the following species, becoming strongly marked in the 7-striate and 12-striate groups.

Specimens of this species with the front normally striate were early referred by LeConte to *semistriatus* Say, while others of the same species (and afterwards so recognized by LeConte) in which the frontal striae were broken up or divided as they frequently are in some degree, served as the types of *novemstriatus*. The name is thus seen to be an unfortunate one, but must stand. Harris observed that in this species the dorsal and apical punctures are placed in shallow foveae and therefore gave it the name *quadrifoveatus* in MS. These foveae are, however, often feeble or obsolete and Harris' name would therefore be but little better than LeConte's.

Novemstriatus inhabits most portions of our territory from northern New England to Florida, and westward to New Mexico. The following localities are known to me: New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, New Jersey, District of Columbia, Maryland, Virginia, North Carolina, South Carolina, Ohio, Iowa, Florida (Pensacola), Alabama (Mobile), Lousiana (Vowell's Mills—Leng.), Nebraska, Kansas, Texas, New Mexico (Cloudcroft, Viereck).

7. *N. nemoralis* n. sp.

This and the following species differ conspicuously from all others of the 5-striate group by the entire or subentire broad lateral yellow stripe of the elytra. Both forms have hitherto passed as *sylvaticus,* but the present one, which is known to me only from Northern New England is quite readily separable from the true *sylvaticus* of the North Pacific coast fauna by the somewhat larger head, slightly less transverse prothorax, which is distinctly more narrowed behind and more coarsely punctate beneath, and by the slightly longer more oval elytra, which are almost always a little more deeply striate. It may be seen at once that this species bears the same relation to *sylvaticus* that *borealis* does to *acquaticus.* It is of course quite possible that *nemoralis* and *sylvaticus* are merely geographical races of one species, but the fact that no intermediate form, nor even a specimen of either has ever been recorded from the three thousand miles of intervening territory makes it probable that they are now completely isolated and distinct. whatever their origin. *Nemoralis* is in fact more nearly related to the European *biguttatus* than to *sylvaticus,* and I was once tempted to consider them identical. A careful comparison shows that biguttatus is a somewhat stouter insect, the prothorax a trifle more transverse and the elytra less elongate, with the second or broad interspace a little wider. According to Putzey's description—the only one at hand—the yellow apical spot frequently reaches the middle of the elytra, but no mention is made of its ever reaching the base, nor does it do so in any of the specimens seen by me.

Nemoralis is more restricted in habitat than any other species known to me, and the greater number of specimens seen are labeled "White Mts., N. H." Other localities—none of them very far from the White Mountains— are Moosilauke, N. H., and Rangely, Me. (Blanchard), and Camels Hump, Vt. (Sprague). Specimens were obtained, writes Mr. Blanchard, by "sifting moss, etc. in the upper woods (White Mts.), and the Rangely specimen occurred several hundred feet above the lakes * * * also sifting in woods."

8. *N. sylvaticus* Esch.

The differential characters between this and the preceding species have already been set forth, and there can scarcely be any excuse for confusing it with any other. Some examples of *semiopacus* show a complete lateral vitta, which is, however, of a paler, duller yellow and quite opaque, not to mention the differently striate front and numerous dorsal punctures by which the latter may always be readily separated.

This species occurs rather commonly in the Coast belt from southern Mendocino County, in California, through Oregon, Washington, Vancouver and British Columbia to Sitka and Kenai in Alaska. It occurs at both low and high altitudes, at least toward the southern portion of its range, having been taken by Dr. Van Dyke "high up on Mt. Rainer, much above 5000 ft., equivalent to an altitude of 8000 or 9000 feet in the southern Sierras."

9. *N. obscurus* Fall.

As indicated in the synoptic table, the present species and *nitens* may be distinguished from our other species by the front having seven striae between the broad lateral grooves. In my original description of *obscurus* the front was described as 8-10 striate, the lateral grooves in this case being counted. In addition to the number of the frontal striae, these two species occupy an intermediate position between the 5-striate and 12-striate groups in several other particulars. In *sylvaticus* a tendency becomes manifest toward a reduction of the punctuation of the under surface of the prothorax. In *obscurus* this is much more marked, the episterna becoming in most specimens very sparsely punctate or almost smooth, a condition which is the rule in *nitens* and *semiopacus*. In *obscurus* the sides of the prothorax are rather sharply rounded or subangulate a short distance behind the apex, thence quite strongly convergent and but feebly sinuate before the hind angles. In *nitens* and *semiopacus* the sides are normally subangulate in front, less convergent and still straighter posteriorly. In *obscurus* there is but one discal puncture except in very rare instances, an extra puncture being present on one side only in two examples of a series of forty specimens. In *nitens* the majority of specimens have two discal punctures, one of which is frequently lost on one or both sides; while in *semiopacus* there are normally three or four punctures, very rarely only two. Although quite variable in size, *obscurus* is on the whole our largest and broadest species (4 1-2 - 6 mm). In color it is rather strongly bronzed, the base of the antennae and tibiae paler. The lateral interstriae are at most slightly alutaceous, often scarcely visibly so except at apex, which is usually obscurely yellowish, the pale shade sometimes extending well forward, becoming gradually evanescent.

Obscurus is known to me only from the Sierras of California, ranging from Shasta (Blaisdell) to San Bernardino, occurring only near the summit of the mountains in the south, but at lower levels toward the north.

10. *N. nitens* Lec.

Closely allied to *obscurus*, but smaller, with relatively smaller head and with the sides of the prothorax straighter and less convergent behind. The elytral striae are as a rule scarcely impressed and more finely punctured, and the lateral intervals are always distinctly alutaceous. In the type there is but a single discal puncture, but the normal number (if there can really be said to be one) seems to be two. In the seven examples at hand, four have two punctures, two have two punctures on one elytron and one on the other, while one has the disk of each unipunctate. In the type there is a yellow spot or vitta in the apical fourth; this is more or less evident in most specimens, but may be entirely absent.

The type and only specimen known to Le Conte was taken by Dr. Cooper at Prairie Paso, Oregon. The species seems not to have since been recognized by collectors, but I am quite confident that specimens taken at Dalles, Oregon and Coeur d' Alene, Idaho, by Mr. Wickham, are the same species. With these I have also placed a Waco, Texas specimen sent by Mr. Knaus, and a perfectly similar one, also from Texas, but without exact locality, belonging to the Cambridge Museum collection These are a little smaller than the northern examples, but scarcely differ otherwise; in each the elytra have two discal punctures.

11. *N. semiopacus* Esch.

The finely very numerously striate front and opaque sutural and lateral intervals of the elytra make the recognition of this species at once easy and certain. The head is barely as wide as the prothorax, the latter less narrowed behind than usual, the sides subangulate in front and nearly straight posteriorly; elytral striae fine, dorsal punctures usually three, rarely two or four, frequently with a dull luteous lateral vitta, which may be entire, or distinct only toward the apex.

Occurs in Oregon and California, all specimens but one known to me being from the latter state. The following Californian localities are represented: San Diego, Poway and Lampson's Flat (Middle Sierras, 1800 ft.)—(Blaisdell); Pomona, Pasadena, San Bernardino (Fenyes) and Catalina Island (Fenyes).

The following bibliography is not complete, but contains, I think, all useful references.

BIBLIOGRAPHY AND SYNONYMY.

Notiophilus Dumeril.

1. *N. aeneus* Hbst. Col. X, p. 235: *semistriatus* Say var. B. Trans. Am. Phil. Soc. 1823, II, p. 82; Edit. LeC. II, p. 498: *porrectus* Say, ibid 1834, IV, p. 418; Edit. LeC. II, p. 530: LeConte Ann. Lye. 1848, IV, p. 450: Harris, Ent. Corr. (Scudder), 1869, p. 213: Crotch, Trans. Am. Ent. Soc. 1876, V, p. 247; Schaupp, Bull. Brook. Ent. Soc. 1878, p. 30.

2. *N. semistriatus* Say, Trans. Am. Phil. Soc. 1823, II, p. 81; Edit. LeC. II, p. 497; ibid 1834, IV, p. 417; Edit. LeC. II, p. 530: Harr. l. c.: *Confusus* Lec. Ann. Lyc. 1848, IV, p. 449: Putz. Mem. Liege 1866, p. 166; *Americanus* Harr. l. c.: *sibiricus* Mots.‡ Crotch, l. c.; Schaupp; *punctatus* Lec. ‡ Shaupp. I. c.

3. *N. aquaticus* L. Kirby, Faun. Bor. Am. 1837, IV, p. 64: Mäklin, Stett. Ent. Zeit. 1857, pp. 185,335; Sahlberg, Vega Exp. 1885, p. 47; (LeConte, Proc. Acad. 1873 p. 321 refers Kirby's species to *semistriatus* Say): Fauvel, Rev. d' Ent. 1889 VIII, p. 95; Hamilton, Trans. Am. Ent. Soc. XXI, p. 6; Ham. l. c.,

p. 350: *punctatus* Lec, Agas. L. Sup. 1850, p. 210: *hardyi* Putz. l. c. p. 165 Crotch, l. c.; Schaupp, l. c.

4. *N. borealis* Harr. l. c.: *punctatus* ‡ Lec. Ent. Corr. p. 213, note.

5. *N. simulator* n. sp.

6. *N. novemstriatus* Lec. Ann. Lyc. 1848, IV, p. 450: *semistriatus* Lec. *quadrifoveatus* Harr. l. c.: *semistriatus* say ‡ Putz. l. c., Crotch l. c., Schaupp, l. c.

7. *N. nemoralis* n. sp. *Sylvaticus.* Esch Auct.

8. *N. sylvaticus* Esch. Zool. Atl. V. 24, tab. 25, f. 5: Crotch, l. c.; Schaupp, l. c.

9. *N. obscurus* Fall. Occa. Pap. Cal. Acad. Sci. 1901, VIII, p. 207.

10 N. nitens Lec. Rep't Expl. and Surv. 1857, p. '1; Crotch, l. c.; Schaupp, l. c.

11. *N. semiopacus* Esch. l. c. V. 25, tab. 25, f. 6: Putz. l. c.; Crotch, l. c. Schaupp, l. c.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXVI.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Cosymbia lumenaria Hübn.

The larva has been observed by Dr. S. H. Scudder, who published descriptions of the last stage and pupa (Psyche, viii, 103, 1897). His description was previously quoted by Packard (Mon. Geom., 363, 1876), who gives also a figure of the larva after Abbott (Mon. Geom., pl. 13, fig. 22, 1876) and of the pupa (loc. cit., pl. 13, fig. 14). The food plant observed by Scudder was sweet fern (*Comptonia*); Abbot gives *Psoralca,* while my larvae fed on blueberry (*Vaccinium*). I have described the egg and first stage in British Columbia larvae (Proc. U. S. Nat. Mus., XXVII., 901, 1904).

Egg Long elliptical, ends rounded, depression slight, the sides compressed, not strongly flattened. Reticulations coarse, even, well raised and rounded, irregularly hexagonal. Size .6 x .3 x .25 mm.

Stage I. Head round, whitish. Body moderate, slender, dorsum and venter broadly dark grey, sides narrowly whitish. Feet pale.

Stage II. Head quadrately rounded, thick, equal, dull luteous with a faint smoky band, later all smoky shaded leaving an erect pale line on each lobe; width .3 mm. Body moderate, normal, dorsum and venter broadly smoky olivaceous black, sides narrowly pale greenish. Thoracic feet pale, abdominal ones blackish, shields and tubercles invisible, concolorous.

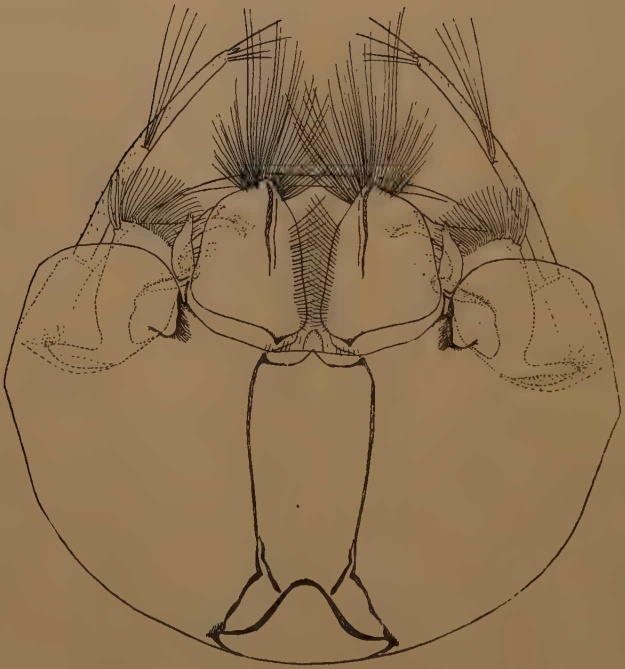
Stage III. Head full, erect, thick, bilobed, finely gray-brown dotted, leaving a pale vertical streak on each lobe; clypeus and a spot each side white; width .4 mm. Body moderate, seeming flattened, broadly velvety brown dorsally and ventrally, sides narrowly bright greenish white, from joint 2 to the anal feet; foot of joint 10 brown. Tubercles, setae and shields concolorous, invisible. Traces of indefinite white subdorsal lines in the brown dorsal area.

Stage IV. Head full, thick and rounded, slightly bilobed, red brown with white dotting; a vertical stripe of white on each lobe with a dot below beside the clypeus, labrum white; width .75 mm. Body moderate, uniform, annulate somewhat irregularly, red brown, sides white, a fine, broken, narrow subdorsal white line, retracted intersegmentally and more distinct than a still finer straight dorsal line. Outline of white lateral area irregular, a little shaded. Feet brown, the anal pair white outwardly. Tubercles small, dark, showing in the white area; setae fine, small.

Stage V. Head moderately bilobed, erect, broad; ground white checkered with red brown in alternating oblique bars, leaving a white streak over the vertex of each lobe and eye, in clypeus and over labrum; a black shade before ocelli; width 1.1 mm. Body broadly dark brown dorsally, shading to olivaceous at the sides, including a narrow pulverulent dorsal and subdorsal line, the latter waved; subventral fold broadly pale yellow. Venter and feet, except those of joint 13, dark blackish vinous. Tubercles small, dark, no shields, setae minute. Segments rather finelv annulate but not distinctly.

Stage VI. Head large, round, thick, distinctly bilobed, light red-brown from the dotting, the ground white, appearing in a vertical streak on each lobe and irregularly over the sides; median suture at vertex and clypeus more blackish, labrum whitish; width 1.6 mm. Body moderate, uniform, smooth. Dorsum brown with velvety black oblique streaks from the segments anteriorly, joining dorsally and extending laterally to the pale yellow subventral area, distinct on joints 5 to 8, smaller on joint 9, scarcely indicated on the other segments. Dorsal line straight, subdorsal waved, pale yellow, broken, dotted; also a broken lateral line, partly confluent with the subventral area. Venter nearly solidly black, dotted with white, forming faintly a double medioventral line. Thoracic feet gray, abdominal ones red-brown, anal ones white-banded without. Another larva was pale but with the same marks. The brown of the dorsal area shades to lilaceous and pales gradually to the subventral area.

Pupa described by Scudder and figured by Packard.



Deinocerites cancer—ventral view of larval head. (Fig. 1.)

NOTES ON DEINOCERITES CANCER THEOBALD.

BY FREDERICK KNAB, WASHINGTON, D. C.

The writer has had occasion to study this mosquito in the course of his work in connection with Dr. L. O. Howard's forthcoming monograph of the Culicidae. As a number of incorrect statements have been published about *Deinocerites* the following observations seem timely.

Deinocerites cancer was found by the writer on both coasts of Costa Rica, at Puntarenas on the Pacific side and at Port Limon on the east coast. The species was first encountered far up the mangrove inlets behind Puntarenas. It was established in the holes of a very large and brightly colored species of crab (*Cardisoma crassum* Smith). These crab-holes were near the head of tide water, above overflow, often a considerable distance from the water, and the water in them must have been very nearly if not quite fresh. In some of these holes on very low ground the water was quite near the surface, and the larvae in great numbers and of various sizes, could be seen suspended by the surface film. About Puntarenas *Deinocerites* appeared to be the only species of mosquito inhabiting the crab-holes. At Port Limon the writer found two other species associated with *Deinocerites* in crab-holes, in fact it was there greatly outnumbered by them. One of these species has been recently described by Mr. D. W. Coquillett under the name *Tinolestes latisquamma* and the other he referred to *Culex scholasticus* Theobald.* Dr. M. Grabham has found *Culex janitor* Theob. associated with *Deinocerites* in crab-holes in Jamaica (Theobald, Monogr. Culic., v. 3, p. 185). At Port Limon the crab-holes were on a side hill, in a cacao orchard at some height above sea-level. The water in them was entirely fresh, supplied by a small brook which had worn a channel into the stiff clay of the hillside. Most of these holes went to a great depth to reach the water, so that the mosquitoes living in them never see the light until they attain the winged state. This record of the occurrence of the larvae of *Deinocerites* in fresh water is not made in contradiction of the previous records of its occurence in brackish water. The larva was found in brackish water by Dr. H. G. Dyar in southern Florida and by Mr. A. Busck in the west Indies and it would seem that it thrives best in brackish water and there the species of *Culex* are not associated with it.

The imagos likewise inhabit the crab-holes and during the day rest upon the sides of the hole. It takes considerable disturbance to drive them out and they then fly slowly out of the hole and sometimes to some other nearby hole. Usually, however, they alight in the immediate vicinity of their hole, upon the ground or very near it, and after a very short interval fly back into the hole. At twilight the adults may be seen dancing in a small cloud close to the mouth of the crab-hole. Mr. Busck, who has had many opportunities to observe *Deinocerites* in the West Indies, has found that the species swarms in the morning twilight as well as in the evening. As with other mosquitoes, the swarming indicates the time of sexual activity and Mr. Busck has frequently noted copulation at such times.

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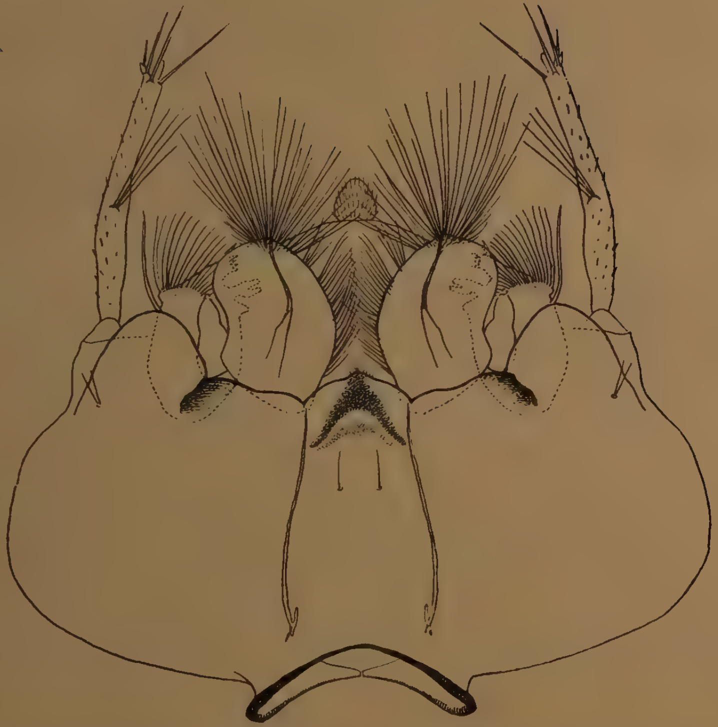
*It is, however, apparently not the form so identified by Dr. Dyar and the writer (Journ. N. Y. Ent. Soc., xiv, 182, 1906).

Dr. Grabham states of *Deinocerites* "only comes out to feed at night, is a voracious bloodsucker" (Theobald, Monogr., v. 2, p. 356). In contradiction Theobald in v. 3, p. 279 of his Monograph quotes Dr. Low who "could never get them to bite. In many dissected from Calliagua, a village in St. Vincent, I never saw any traces of blood in their stomachs." In the writer's experience, *Deinocerites* could never be induced to bite nor would it even alight upon the person. Mr. Busck is also quite positive that it does not molest man. In Trinidad numerous crab-holes, each with its swarm of *Deinocerites*, are found in the immediate vicinity of the houses—often within a few feet. Still these mosquitoes never enter the house nor is anyone ever bitten by them. Perhaps the larvae even serve a useful purpose in preventing the water in the crab-holes from becoming offensive.

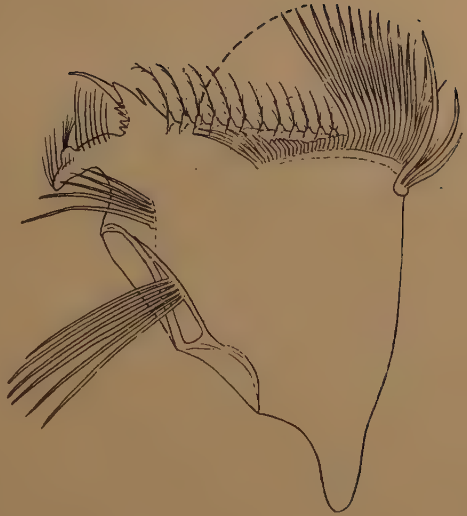
While this mosquito is remarkable in many ways there are no structural characters which, in the writer's opinion, justify the creation of a distinct subfamily for it as has been done by Miss E. G. Mitchell in Psyche, v. 13, p. 19. The unusual length of the second antennal joint, brought forward as a discovery of Mr. Coquillett, has already been commented on at some length by Theobald (Monogr. v. 2, p. 215-217; v. 3, p. 275-277).

The larval peculiarities of *Deinocerites* pointed out by Miss Mitchell are merely an amplification of structures present in other Culicid larvae. The groove in which the mandibles move is by no means peculiar to *Deinocerites* but common to all mosquito larvae and present in the larvae of many other Nemocera. To show the correspondence of parts and their modification ventral views of the heads of *Deinocerites cancer* and *Janthinosoma jamaicensis* are here figured. The integument of the ventral surface of the head is transversely folded in the region of the mouth and forms a ridge extending entirely across the head. In the depression behind this ridge lies the mouth with its ap-

PLATE V.I.



Janthinosoma jamaicensis—head of larva, ventral view. (Fig. 2.)



Culex vector D. & K.—mandible of larva. (Fig. 3.)

pendages. It is this transverse ridge with its supporting chitin laterally expanded that forms the projecting angles so characteristic of *Deinocerites*. The same lateral expansion of this region occurs again in the larva of the Sabethid *Lesticocampa lunata* Theobald. The modification of the ridge into rounded lobes, outward from the maxillae, as illustrated in the accompanying figure of *Janthinosoma jamaicensis,* occurs in most mosquito larvae but may be absent, as in *Psorophora.* The mandibles are truly most strikingly modified in *Deinocerites* but they are by no means unique, as Miss Mitchell asserts. There are no less than five species of *Culex* known to the writer which present similar modifications in the form of the mandibles. A mandible of one of these species, *Culex vector* Dyar Knab, drawn by Miss Mary Carmody, is here reproduced (fig. 3). It will be noted that the basal portion of the mandible, instead of being rounded off as is the case in most mosquito larvae, is drawn out into a slender straight projection which corresponds to the curved projection in *Deinocerites.* The toothing of the cutting surface of the mandibles shows various modifications, particularly in the tropical species examined by the writer, but it is doubtful that they will have any classificatory value.

Miss Mitchell has fallen into error in her description of the labial plate of *Deinocerites.* There are three of these structures, overlapping each other, present in Culicid larvae. Usually the outer one of these plates is the stoutest and heavily pigmented so that it obscures the other two which are more delicate and transparent. It is this outer heavily chitinized plate which has been made use of in descriptive work, while the other two have remained unnoticed or at least disregarded. It is one of these inner plates that Miss Mitchell describes in her article. The outer plate is perhaps difficult to find in dissecting, but it is obvious enough when the entire head is examined ventrally. It is usually small, and pale like the head integument, but its general form corresponds with that of other mosquito larvae. It may be remarked in conclusion that Raschke (Die Larve von Culex nemorosus 1887) does not consider this plate a labial structure but as belonging to the integument of the gular region. M. T. Thompson has recently expressed the same belief and terms the part "mental sclerite," (Proc. Boston Soc. Nat. Hist., v. 32, p. 170).

THREE NEW SPECIES OF NEUROPTERA.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

New species of the true Neuroptera are not abundant in our country, and the three following species represent recent additions to my collection. The *Allochrysa* is one of the largest and most elegant of our Chrysopidae; while the *Panorpa* is interesting, since it shows the value of the male genitalia. By the wing-markings this species resembles two of our most common forms, but the genitalia show that it is related to a different section of the genus. With these three new species I have added new names for three old species, two of which had preoccupied names, and the other based on a mis-identification.

Allochrysa arizonica n. sp.

Head pale greenish yellow, cheeks rufous, last joint of palpi marked with a red band; an angulate red band just above antennal sockets from eye to eye. Thorax greenish yellow, a red spot on each anterior corner of the prothorax, and an angulate red band on the front part of mesothorax from wing to wing; abdomen brownish, discolored, bases of ventral segments paler; legs pale yellowish, the claws reddish. Wings hyaline, venation pale greenish, the bases of the cross-veins between the radius and sector blackish, the gradate series dark, and some of the cross-veins in basal part of wing more or less dark; hind wings pale, venation pale; the pterostigma brown, much more prominent than in the fore wings.

Expanse 52 mm.

One specimen from Palmerlee, Arizona (Biederman). Differs from *A. virginica* in red bands on head and thorax, and in absence of dark spot at end of cubitus in fore wings.

Chrysopa majuscula n. n.

I propose this new name for my *Chrysopa erythrocephala,* which name is preoccupied by Leach for an European species.

Chrysopa injusta n. n.

I propose this name to replace my *Chrysopa marginalis;* Father

Longinos Navas has published a *C. marginalis* a few months before me in the Bol. Soc. Aragon. Cienc. Nat., IV., May 1905.

Psammoleon guttipes n. sp.

Myrmeleon ingeniosus Hagen, Syn. Neur. N. America, p. 236, 1861, not of Walker.

Walker's type of *Myrmeleon ingeniosus* is from Brazil. It has a much narrower pronotum, the thorax is more spotted, the abdomen more banded with pale, and the legs not sprinkled with black dots; I therefore propose a new name for our species. Hagen had already noticed these differences in 1860, but had few specimens; since then it has been found that these forms are more constant in markings than formerly supposed.

Suhpalasca floridana n. sp.

Head brown, clypeus and mouth-parts yellowish; vertex with dark brown hair, face with two rosettes of long, dark brown hair each side; antennae pale, narrowly annulate with brown, club dark brown; thorax brownish; legs pale, tips of the tibiae and of all tarsal joints black, spines black. Abdomen brown, segments 4, 5 and 6, with a narrow, curved black stripe on each side above, margined with yellow; tip each side with a yellow spot containing a black dot on posterior edge; male appendages pale, scarcely one-half the length of the last dorsal segment, depressed. Wings hyaline, venation pale brownish, pterostigma pale brown. Structure similar to *S. hyalina*.

Expanse 50 mm.

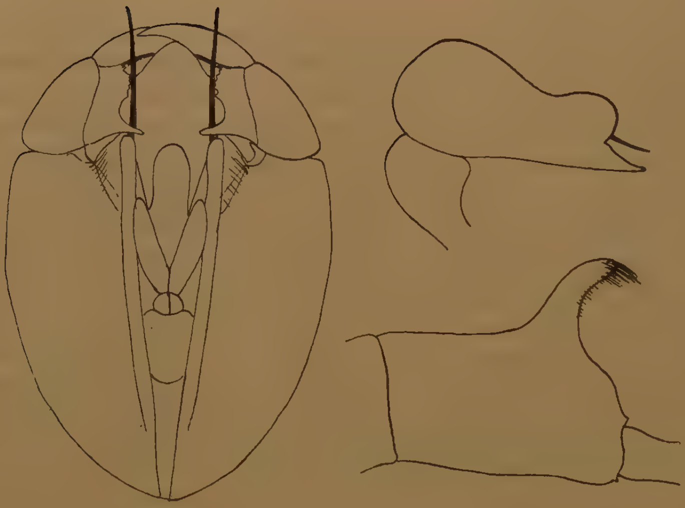
One male from Southern Florida. Differs from *S. hyalina* at once by the dark hair on face, as dark as that on vertex. Dr. H. W. van der Weele, who is making a special study of this family, writes me that our species of *Ulula* (*Ululodes* Currie) belong to the genus *Suhpalasca.*

Panorpa virginica n. sp.

Pale yellowish; antennae black, except the basal joints; abdomen brown, apex yellowish. Wings hyaline, faintly yellowish on basal part; a rather broad apical band; a narrow, geniculate pterostigmatical band; an interrupted basal band of two equal spots; three basal spots, the central one the largest, a costal spot beyond basal band; and a posterior marginal spot between pterostigmatical and apical bands. In hind wings only the three bands distinct. Subcosta runs into the pterostigma; wings not very long. Sixth abdominal segment of the male rather short, with a large, high, curved horn above, somewhat before the tip. Genitalia as figured; the apical joint with a large lobe above, toothed on inner margin, harpes very slender.

Length fore-wing 12 mm.

Two males from Falls Church, Va., 11 August, and 10 October. By structure of genitalia it is related to *P signifer* and *P subfurcata;* but the horn on sixth segment is much larger and the lobe of genitalia of different shape; it is quite different in markings, and in this respect much like *P. rufescens.*



Panorpa virginica; end view of male genitalia; side view of same, and side view of fifth abdominal segment.

ROLAND HAYWARD.

ROLAND HAYWARD.

BY SAMUEL HENSHAW, CAMBRIDGE, MASS.

Roland Hayward, who died at Milton, Massachusetts, April 11, 1906, was born in the house in which he died, March 7, 1865. The son of Isaac Davenport and Mary Bartlett (Vose) Hayward, he was educated at the best private schools in Boston, and entered the Lawrence Scientific School, Harvard University, in 1882; though he continued his studies in Cambridge until his senior year, he did not attempt, on account of ill health, the examinations necessary for graduation. After a brief service in a banking office, he became, on December 30, 1887, a member of the Boston Stock Exchange; at first by himself, and later associated with Mr. W. S. Townsend, for fifteen years until his retirement, July 1, 1902, his business relations were noted, as was his life, for the strictest integrity and loyalty.

Though Hayward's love of nature can not be traced to any ancestor, the place of his birth may well have been influential; for here, where the greater part of his life was passed, under the shadow of one of the most beautiful of the lesser hills of New England, he found keen enjoyment in rambling through the pastures and meadows, for many generations the possession of his forefathers. Here the nucleus of his collections of birds' eggs, butterflies, and beetles was gathered; and here a pursuit, not unusual for a boy, matured into the work of a scientific man, work that was conscientious and thorough, and unusual for one actively engaged in business, and thwarted by a severe physical illness.

Though his active business career limited the number and extent of his holidays, Hayward made collecting trips to Colorado, Manitoba, New Brunswick, and to many sections of New England, and by his own efforts accumulated a serviceable series of the Coleoptera of North America. This series was increased by gift, exchange, and judicious purchase and by will devised to the Museum of Comparative Zoölogy.

Roland Hayward, when a lad of less than fourteen, was admitted as a member of the Boston Society of Natural History, a Society whose exhibited collections of New England insects did much to focus and cement his life interest in entomology, and to this institution he bequeathed from his library such works on entomology as were not already its property. He was a founder of the Boston Zoölogical Society, a short-lived Club of boys and young men, to whose credit-able Quarterly Journal Hayward contributed several short notes. Elected to active membership in the Cambridge Entomological Club, December, 1879, he was at all times alert to the interests of the Club, serving first on the Council, and later as Secretary from January, 1886, to January, 1903, and as Treasurer from January, 1901, until his death.

Hayward's two important systematic papers deal with difficult genera, Bembidium and Tachys, of the Carabidae; a third paper, "Studies in Amara," practically completed before his death, will be issued by the Amreican Entomological Society. These papers, the result of patient and earnest effort, contain the essentials of good taxonomic work: the tables are clear and consistent; the descriptions adequate and careful, detailed but not redundant; the habitats recorded in full; and the bibliographic citations accurate. Hayward was, moreover, eminently fair to the work of his predecessors; he strove long and successfully in order that he might learn the personal equation of each author.

The list which follows includes the more important writings of Roland Hayward, but some short notes and the reports of verbal communications are not recorded.

LIST OF WRITINGS.

1. 1882. *Selenophorus ellipticus* at Nantucket. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 10.
2. 1882. Notes on the habits and distribution of the Massachusetts Rodentia. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 13-18.
3. 1882. Another spotted egg of *Empidonax minimus*. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 26.
4. 1882. Habits and transformations of *Bolitotherus bifurcus* Fab. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 35-36.
5. 1882. Two rare Carabidae from eastern Massachusetts. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, pp. 37-38.
6. 1882. *Cicindela ancocisconensis* (Harr) in Vermont. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 1, p. 38.
7. 1883. A catalogue of the Coleoptera of the Green Mountains. [With Henry Savage.] *Quarterly Journ. Boston Zoöl. Soc.*, vol. 2, pp. 12-15; 24-29; 36-38.
8. 1883. Rare Lepidoptera around Boston during the past summer. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 2, p. 56.

9. 1883. A note on *Acmaeodera culta*. *Quarterly Journ. Boston Zool. Soc.*, vol. 2, p. 56.

10. 1884. On the sexual characters of *Boletotherus bifurcus*. *Quarterly Journ. Boston Zoöl. Soc.*, vol. 3, pp. 16-17.

11. 1885. Curious food for the Kingfisher (*Ceryle alycon*). *Auk*, vol. 2, p. 311.

12. 1897. On the species of Bemlidium of America north of Mexico. *Trans. Amer. Ent. Soc.*, vol. 24, pp. 32-143.

13. 1897. Preliminary hand-book of the Coleoptera of northeastern America. [Bembidium]. *Journ. N. Y. Ent. Soc.*, vol. 5, pp. 133-149.

14. 1900. A study of the species of Tachys of Boreal America. *Trans. Amer. Ent. Soc.*, vol. 26, pp. 191-238, plate 6.

15. 1901. Synonymical notes on Bembidium and descriptions of new species. *Trans. Amer. Ent. Soc.*, vol. 27, pp. 156-158.

16. 1901. The katydid's call in relation to temperature. *Psyche*, vol. 9, p. 179.

17. 1902. A note on the secondary sexual characters of Omophron. *Psyche*, vol. 9, p. 304. *Cf.* p. 335.

18. 1904. An abnormal specimen of *Bembidium scudderi*. *Psyche*, vol. 11, p. 14.

19. 1905. On the secondary sexual characters of Notiophilus. *Psyche*, vol. 12, p. 95.

A NEW CARIPETA.

In going through Packard's Monograph of the Geometridae, I find that he made an error in calling Figure 52, Plate IX, *Caripeta angustiorata* of Walker; and since the insect figured is undescribed I propose the name *Caripeta criminosa* for it. Detailed description with particulars will follow in the September number of the Journal of the New York Entomological Society.

L. W. Swett.

RECENT ENTOMOLOGICAL LITERATURE.

GENERA INSECTORUM; CHIRONOMIDAE. BY DR. J. J. KIEFFER.

The forty-second part of Wytsman's Genera Insectorum, written by Dr. J. J. Kieffer, which has just appeared, deals with the Chironomidae. While there are no startling innovations in classification, the author has erected several new genera by division of some of the older ones. The family is divided into five subfamilies; the Clunioninae, Tanypinae, Chironominae, Ceratopogoninae, and Stenoxeninae. The second, third and fourth subfamilies correspond approximately to Meigen's genera, Tanypus, Chironomus, and Ceratopogon. The position of Diamesa among the Tanypinae may be questioned, for both larval and imaginal characters point to a much closer relationship to Orthocladius and Thalassomyia among the Chironominae. The family Stenoxenidae is here reduced to subfamily rank under the Chironomidae, thus following Aldrich. Wulpiella is made a synonym of Metriocnemus; four subgenera are erected under Orthocladius; Diamesa is broken up into two genera, Prodiamesa and Diamesa, the latter with two subgenera; Psilotanypus is separated from Procladius; Protanypus from Anatopynia, and Trichotanypus from Tanypus. In the subfamily Ceratopogoninae, Heteromyia and Serromyia have been raised to generic rank, while Ceratopogon, Bezzia, and Palpomyia each have two or three subgenera under them.

Considering the extent of the work, very few errors of either omission or commission can be found. The following, of interest to American readers, may be noted. Orthocladius fugax cannot belong to the subgenus Dactylocladius since it is said to have hairy eyes; Diamesa nivoriunda Fitch (p. 36) should be omitted (See Bul. N. Y. State Museum No. 86, p. 274, line 15); Tanypus steinenii Gercke is not North American; Culicoides scutellatus Meigen is classed with both Culicoides and Ceratopogon; Bezzia venustula is listed with both Ceratolophus and Bezzia; Ceratolophus pictus seems to be omitted; and Thalassomyia fusca (No. 3, p. 14) should be omitted; it is the same as Th. obscura and the name is due to a *lapsus memoriae* on the part of its author. The name Ceratolophus is preoccupied and should be changed. The four plates which show figures of wings and other details of structure are excellent, in many cases better than the originals from which they are copied.

The paper is a noteworthy contribution to the study of the Chironomidae and the author, Dr. Kieffer, is to be congratulated upon its excellent arrangement and fine appearance.

O. A. JOHANNSEN.

PROCEEDINGS OF THE CLUB.

The 255th regular meeting of the Cambridge Entomological Club was held in the rooms of the Appalachian Mountain Club on Tuesday evening, March 20, 1906, with fifteen members present. In the absence of the President, Mr. Emerton occupied the chair. Mr. Frost was elected secretary pro tem. Reading of the minutes of the previous meeting postponed.

The subject of "Winter Collecting" was opened by Mr. Emerton and several undetermined species of small insects exhibited. Mr. Sampson said he had tried his light during the warm weather of January and had seen one moth that was attracted by it. The remarks finally drifted into a discussion on the liberation or emergence of Lepidoptera during the winter months. The fresh and unrubbed condition of many captured specimens was used as an argument in favor of the latter theory.

Mr. Kincaid exhibited a box of Coleoptera that he had collected during a six weeks' stay at the Bermudas and remarked on the scarcity of the insects of this order on those islands. He said that many of the specimens exhibited were rare and some new to the fauna of the Bermudas.

Mr. C. A. Frost presented a paper on the alder weevil, *Attelabus rhois* Boh., and its parasite, containing his investigations of their habits, and the method of constructing the nest or egg roll.

The rest of the evening was given over to informal conversation and an examination of the collection of spiders in alcohol and the models of different kinds of webs that had been placed on public exhibition in the rooms by Mr. Emerton.

C. A. Frost, *Sec. pro tem.*

The 256th regular meeting of the Cambridge Entomological Club was held in the rooms of the Applachian Mountain Club on Tuesday evening, April 17, 1906, with thirteen members and one visitor present. President Field in the chair. Records of previous meetings read and approved.

The President announced the death of the Treasurer of the Club, Mr. Roland Hayward, and appointed Messrs. Johnson, Newcomb and Emerton to draw up an expression of regret to be entered on the records. The committee presented the following statement which was accepted by the Club:

"It is with deep regret that we record the death of Roland Hayward, for twenty-seven years a member of the Club and of late its Treasurer, who died at his home in Milton on April 11, 1906. He made a special study of the Coleoptera. He had contributed many papers upon the order and at the time of his death was engaged upon a monograph of the genus Amara. The Club hereby expresses its high esteem for Mr. Hayward as a brother entomologist and its keen sense of loss at his untimely death."

Mr. Bowditch was elected Treasurer to fill the vacancy caused by the death of Mr. Hayward; and Mr. Frost was elected Secretary in place of Mr. Clark, resigned. Mr. Andrew J. Lloyd of Boston and Mr. W. T. M. Forbes of Amherst were unanimously elected to active membership.

Mr. Emerton explained the purpose of the organization of the Federation of Natural History Societies and read a draft of the By-Laws. Mr. Denton was elected to represent the Club at the meeting of the delegates in Boston on April 28, 1906.

Mr. Titus, employed by the Division of Entomology at Washington, D. C., and Secretary of the Washington Entomological Society, spoke briefly on the work of examining and caring for the imported parasites of the Brown-tail and Gypsy moths at Lynnfield, Mass. He said that many European species of spiders were appearing from the Brown-tail nests, and that they would be liberated along with the primary parasites.

Mr. Denton exhibited a specimen of *Rhèscynthus semialba* from Central Africa, a large beautiful moth which, so far as he knew, was represented by only one other specimen in the country.

Dr. Russell exhibited photographs of some remarkable examples of the webs of *Archips cerasivorana* that occurred in Winchendon several years ago. He also showed a fine series of the moth with two species of Hymenopterous and two species of Dipterous parasites. For the New England collection, he had two boxes of specimens of the genus Apatela (Acronycta) which were taken at Winchendon, Mass.

Mr. Newcomb, who has been making automobile trips with the Superintendent for Suppressing the Gypsy and Brown-tail moths, spoke very highly of the work that is being done by the employees and the men in charge.

After that, informal conversation and adjournment.

C. A. **Frost**, *Secretary.*

ERRORS IN THE APRIL–JUNE NUMBER OF PSYCHE.

A number of very unfortunate errors marred the last issue of this journal. The most serious was the omission of the name of Mr. Weeks' new butterfly, Carystus ambrosei. To remedy this defect a corrected rendering of pages 67 and 68 is furnished with this number, and each subscriber is requested to make the substitution at once. Mr. Girault has furnished the necessary corrections for his article, and they are printed below.

THE EDITORS.

THE BEDBUG, CIMEX LECTULARIUS LINNAEUS.

Errata et Corrigenda, Part II[a].

Page 42, foot note *a*, 2nd line,	*lectnlarius*	read	*lectularius*.
Idem. 3rd. line,	*Clinoris*	read	*Clinocoris.*
Page 45, third paragraph, last line,	*d'entrés*	read	*d'entrée.*
Page 46, Idem, 2nd line,	omit the letter *l* before *séances.*		
Page 47, second paragraph, last line,	*trasmit*	read	*transmit.*
5th paragraph, lines 2 and 3,	*verstchiedener*	read	*verschiedener*.
idem, 3rd line,	*Centralblats*	read	*Centralblatt.*
Page 52, third paragraph, 3rd line	*Boil.*	read	*Biol.*
Idem, sixth paragraph, last line,	*Laidy*	read	*Leidy.*
Page 54, third paragraph, 1st line	*memoires*	read	*mémoires.*
idem, 6th line,	*gives*	read	*give.*
4th paragraph, 1st line	*Jordens*	read	*Jördens.*
Page 56, 4th paragraph, 1st line,	*Kunckel*	read	*Künckel.*
idem 6th line	*oderiferous*	read	*odoriferous.*

ALEC. ARSÈNE GIRAULT.

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[a] Psyche, XIII. 1906, pp. 42—58.

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NOTES ON THE BEES OF SOUTHERN MAINE: ANTHOPHORIDAE, HALICTOIDIDAE, MACROPIDAE AND PANURGIDAE.

BY J. H. LOVELL AND T. D. A. COCKERELL.

THE Anthophoridae, which are represented by numerous species in the Middle States, become comparatively rare in northern New England. At Waldoboro in southern Maine there have been taken as the result of much diligent collecting only five species of Melissodes and one of Clisodon. With few exceptions, which will be noted under the respective species, they are visitors in this locality of the Compositae and fly during midsummer and early autumn. With the exception of Melissodes desponsa Sm., which is rather common, they might easily escape the attention of the general entomological collector.

MELISSODES.

Melissodes desponsa Sm.

? 1854 *Melissodes desponsa* Sm. ♀, Cat. Hym. Brit. Mus. 2:310.

This is the commonest species of Melissodes in this locality, and has been taken from July 21st to September 1st. It is a frequent visitor of the larger thistles, especially the pasture thistle (*Carduus odoratus*), though occasionally it is taken on the Canada thistle (*Carduus arvensis*). It also visits more rarely a number of other flowers, as *Pontederia cordata, Inula helenium* and the goldenrod.

Length of ♀ 12–14 mm. Length of ♂ 11–12 mm. This species is readily recognized by its robust form, the thorax clothed with ochraceous pubescence, and the black abdomen without fasciae. The male closely resembles the female, but is readily distinguished by the yellow clypeus and longer antennae; the labrum is entirely black. The female has the hair of occiput black, and the nervures black; it is questionable whether it is Smith's *desponsa.* For this species Robertson has proposed the name *M. cnici.*

Melissodes agilis Cress.

1878 *Melissodes agilis* Cress. ♂, Proc. Ac. Nat. Sci. Phil. p. 204.
1878 *Melissodes aurigenia* Cress. ♀ ♂, Proc. Ac. Nat. Sci. Phil. p. 212.

This species is regularly taken each year on the garden sunflower, but has never been collected on the inflorescence of any other plant. It flies from August 10th to September 2nd. This bee, especially the males, is very active upon the wing and easily frightened. One male is very remarkable, being a partial gyandromorph, with a male antenna on the left side and a female one on the right. The name agilis has priority of place, but the more northern aurigenia form (to which the Maine specimens belong) appears to be more widespread.

Melissodes illata n. sp.

♀.—Length a little over 8 mm. Black, resembling *M. perplexa* Cr., but smaller and less robust, also closely related to *M. vernoniae* Robt., but clypeus of male yellow, and size smaller. Clypeus usually, labrum and upper part of face bare; clypeus rather coarsely and mesothorax finely punctured; sides of face below the insertion of the antennae, pleurae and sides of metathorax clothed with grayish pubescence; hair on vertex mixed with black; dorsum of mesothorax and scutellum covered with short black pubescence, which extends to the tegulae. Wings dusky with nervures and tegulae black. Legs fuscous, posterior pair with scopa on tibiae and outer side of basal joint of tarsi pale ochraceous. Abdomen small, oval, narrowly convex and shining; 1st segment bare except for erect white hairs at base; 2nd segment with oblique fasciae on the sides, interrupted in the middle, also a narrow hair band at base; median white fasciae on 3rd and 4th segments entire; the two apical segments clothed with black hair.

♂.—Length 8 mm. Antennae about the length of the body, fulvo-ferruginous beneath; pubescence longer and more dense than in the female; clypeus and large lunate spot at the base of labrum lemon yellow. Pubescence of legs griseous, on inner side of tarsi orange-red, apical tarsi rufous, tibial spurs pale yellow. Apical margins of abdominal segments testaceous, shining; abdominal fasciae median as in the female, but the band on 2nd segment entire, or nearly so. Acute lateral spines on the extreme sides of the two apical segments.

The female is very like *M. perplexa*, but smaller (perplexa has the size and build of *simillima*); the male is easily known from perplexa by the yellow (instead of creamy-white) clypeus, the upper part of which is not black. Herein it resembles

M. manipularis Smith, but that species has the light hair of the thorax differently colored. All specimens of the female were taken on *Solidago* from August 3rd to August 26th. The male specimens were collected from July 23rd to August 13th on *Epilobium angustifolium, Inula helenium,* and *Solidago.*

Melissodes simillima Robt.

1897 *Melissodes simillima* Robt. ♀ ♂, Trans. Ac. Sci. St. Louis, 7:355.

This species is distinguished from *M. illata* by its larger size, broad abdomen, black fascia on segment four, and red apices of mandibles. *M. simillima* is close to *M. perplexa,* but the female differs from cotype of perplexa by the ocherous tint of the pubescence of thorax, the black hair of middle of face and lower part of pleura, and the color of the hair on fourth abdominal segment. Typical *perplexa* is from Georgia. Collected on *Solidago* and *Carduus arvensis* from August 7th to September 3rd.

Melissodes apicata n. sp.

♀.—Length 10 mm. A robust species with white pubescence. This species differs from *illata, simillima* and *perplexa* in having the white abdominal fasciae of fine tomentum apical instead of median, that on the second segment failing in the middle. Facial quadrangle broader than long; clypeus bare, closely and confluently punctured; labrum clothed with pale ferruginous hairs; mandibles rufous at tips; antennae dark with flagellum faintly reddish beneath. Mesothorax with strong punctures on a very shiny ground; hair of disc of mesothorax black, separated from tegulae by a narrow strip of white. Wings strongly dusky, tegulae black. Scopa of hind legs white; hair on inner side of basal joint of hind tarsi nigrofuscous; hair on inner side of middle tibiae largely dark. The abdomen is without metallic tints; abdominal segments 2–4 with white apical fasciae, interrupted on 2; the two apical segments with black hair.

The abdomen and hind legs are very suggestive of those of *Tetralonia actuosa* Cress., although the abdomen is not nearly so rugose as in that species, and the color of the apical hair and the sculpturing of the mesothorax is entirely different. One specimen on the flowers of *Pontederia cordata,* July 21, 1904.

CLISODON.

Clisodon terminalis Cress.

1869 *Anthophora terminalis* Cress. ♀ ♂, Trans. Am. Ent. Soc. 2 : 292.

1879 *Clisodon terminalis* Patton, Bull. U. S. Geol. Surv. 5 : 479.

One female on the flowers of *Pontederia cordata*, July 21, 1904. No species of *Tetralonia*, *Xenoglossa*, or *Anthophora*, have yet been recorded from Maine.

Intermediate between the old divisions of Andrenidae and Apidae there are numerous genera of bees, representing different phylogenetic lines, but possessing the common character of two submarginal cells. They are of special interest to the floroecologist from the fact that many species are oligotropic flower-visitors. In the arid regions of New Mexico it has been observed that most species of Perdita, which are in that area numerous, confine their visits to one kind of flower.* As so little is known of the bees of northern New England, it seems desirable to enumerate the Maine species belonging to this group, and to note their times of flight and flower records.

HALICTOIDES.

Halictoides novae-angliae Robt.

1897 *Panurgus novae-angliae* Robt. ♂, Trans. Ac. Sci. St. Louis, 7 : 339.

1904 *Conohalictoides lovelli* Vier. ♀ ♂, Ent. News, 15 : 244.

This species is a common visitor of *Pontederia cordata*, but it has never been collected on any other aquatic or upon any land plant. The writer knows of no other common bee found at Waldoboro, which entirely restricts its visits to one species of flower. Mr. H. L. Viereck in his description in Entomological News states that this bee is also found at Derby, Pa., and at Chestertown, Md. Robertson described it from "Mass., Ct. (A. P. Morse)."

MACROPIS.

1880 *Macropis ciliata* Patton, ♀ ♂, Ent. Mo. Mag. 17 : 31.

The females of this genus are usually regarded as oligotropic visitors of Lysimachia. I have, however, found *M. ciliata* ♀ a common visitor to the umbels of

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* Cockerell, T. D. A. Notes on New Mexican Flowers and their Insect Visitors. Bot. Gaz., 1897, p. 104.

Aralia hispida. Besides this plant the female also visits *Lysimachia terrestris* and *Kalmia angustifolia.* The males visit *Aralia hispida, Sedum acre, Kalmia angustifolia* and the goldenrod. Taken from July 10–27.

PERDITA.

Perdita octomaculata Say.

1824 *Panurgus octomaculatus* Say, ♀ ♂, Long's 2nd Exp. 2:350.
1888 *Perdita octomaculata* Provancher, Add. faun. Can. Hym. p. 321.

Common on *Solidago juncea* from August 1–27, the females collecting pollen. In one instance this bee was seen on another species of goldenrod.

CALLIOPSIS.

Calliopsis andreniformis Sm.

1853 *Calliopsis andreniformis* Sm. ♀, Cat. Hym. Brit. Mus. 1:128.

Only two females and three males of this species have been taken at Waldoboro (July 10th to August 7th); and the only flower record is *Solidago juncea,* August 7, 1904. It is rather singular that all five specimens were collected in 1904; while in 1905, when a special effort was made to obtain as many species of Anthophila as possible in this locality, no specimens of *C. andreniformis* were found.

PANURGINUS.

Panurginus asteris Robt.

1895 *Calliopsis asteris* Robt. ♀ ♂, Trans. Am. Ent. Soc. 22:121.

One male specimen taken on Solidago, August 17, Waldoboro, Maine. In the table in Trans. Am. Ent. Soc., Dec. 1898, p. 197, this runs to 35, and cannot be separated from *P. asteris* Robt.

NEW DASCYLLIDAE.

BY CHARLES SCHAEFFER, BROOKLYN, N. Y.

Lachnodactyla texana new species

Piceous brown, antennae and legs paler, form of *Ptilodactyla serricollis*, but slightly more robust and the vestiture coarser. Head granulate-punctate; eyes large, separated by slightly less than their own width; antennae long and slender, joints four to ten each with a ramus, which is much longer than the joint to which it is attached. Prothorax twice as wide at base as long, sides compressed anteriorly, arcuately converging behind, hind angles acute and slightly reflexed; base bisinuate, denticulate; surface convex, feebly depressed behind, not very densely granulate-punctate. Scutellum moderate, sub-cordiform, not impressed at base but with four denticles. Elytra elongate, very little wider than the thorax at base, humeri rounded; punctate-striate, striae distinct, intervals finely and sparsely punctate. Apex of fifth ventral segment feebly emarginate. Length 6 mm., width 2.75 mm.

Esperanza Ranch, Brownsville, Texas, May 30, one male.

Differs from the Central American *monticola* by the head being granulate-punctate, scutellum without notch in front and with only two teeth on each side of base, the elytral striae distinct and finely but not rugosely punctate. Some of these characters separate it also from *parviscutum*.

Lachnodactyla arizonica new species.

Ferruginous-brown, closely resembling *Ptilodactyla serricollis*, but slightly more elongate. Head granulate-punctate; eyes rather small, widely separated by more than their own width; antennae slender, ramus of each joint as long, or very slightly longer, than the joint itself, last joint elongate-oval, slightly wider than the penultimate. Thorax at base twice as wide as long, bisinuate, denticulate; sides arcuately narrowing to apex; hind angles acute and feebly reflexed; surface convex and feebly depressed behind. Scutellum moderate, feebly cordate, median impression deep in front, but base without denticles on each side. Elytra elongate, slightly broader than the thorax at base, obsoletely punctate-striate, intervals flat, feebly rugose and finely punctate. Fifth ventral segment at apex feebly emarginate. Length 5 mm., width 2.5 mm.

Huachuca Mts., Arizona, July 25, one male.

This species differs from *texana* by the smaller, more widely separated eyes, rami of antennal joints shorter, scutellum distinctly impressed in front and without denticles on the basal margin; this latter character and the granulate-punctate head separate it also from the two Central-American species.

The genus *Lachnodactyla* is closely related to *Ptilodactyla*, from which it is mainly distinguished by the last joint of maxillary palpi being very elongate and somewhat cultriform, and the third very small. The apical joint in the male is cleft on the inner side and spongy within, the insect apparently having the power of distending it at will as Mr. Champion suggests.

If the figure* of the maxillary palpus is correct, the two species above described differ also from the two Mexican species in the third joint being inserted at the sides near base of the last joint; the palpi having thus somewhat the form of the antennae of certain species of Lachnosterna.

ORA TEXANA Champ. Biol. Cent. Am. Col., vol. III, pt. i, p. 604 (note).

This name is given to the *Scirtes troberti* of Dr. Horn,† which, according to Mr. Champion, is distinct from the Mexican species.

ORA TROBERTI Guér. Rev. et Mag. Zool. 1861, p. 545.

I have a specimen from Brownsville, Texas, which agrees with the description of this species and also nearly with the figure given in the Biologia,‡ except that the elytra are brownish testaceous and not yellow and the third dark elytral stripe is narrowly confluent with the apical dot. I am unwilling to give the single specimen a new name on these variable differences, as it otherwise closely agrees in form, markings, etc., with the Mexican insect.

The genus *Ora* is closely allied to *Scirtes* from which it is separated by the posterior coxae being contiguous in front only, posteriorly separated by the intercoxal process; the thorax and elytra explanate and acutely margined.

Scirtes plagiatus new species.

Ovate, reddish testaceous, head, thorax and an oblique lateral stripe on each elytron piceous. Head shining, finely and sparsely punctate and sparsely pubescent. First joint of antennae stout, second and third small, together as long as the fourth, fourth to tenth feebly decreasing in length, eleventh slightly longer than the tenth and rounded at apex. Thorax very strongly transverse; sides narrowing to apex, apical angles rounded, basal angles feebly so; base arcuate; surface finely and rather sparsely punctate and sparsely pubescent. Scutellum triangular, finely and sparsely punctate. Elytra more strongly punctate than the thorax, sparsely pubescent with fine, recumbent, pale hairs; color reddish testaceous, with an oblique, piceous vitta on each side, extending to about apical fourth, leaving apex and the suture narrowly pale. Body beneath sparsely pubescent; tibiae carinate. Length 3 mm., width 2 mm.

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* Biol. Cent. Am. vol. III, pt. 1, pl. 27, fig. 25a.

† Trans. Am. Ent. Soc., vol. VIII, p. 102, pl. 1, fig. 15.

‡ Biol. Cent. Am. vol. III, pt. 1, p. 603, tab. xxvi, fig. 24.

Huachuca Mts., Arizona, June.

Readily distinguishable from all the described species by the coloration.

LIFE HISTORIES OF NORTH AMERICAN GEOMETRIDAE.—LXVII.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Euchlaena effectaria Walker.

Egg. Elliptical, rounded, depression and truncation not strong, rounded, the truncation a little oblique. Reticulations large, hexagonal, distinct, tending to lie in longitudinal rows but the cross striae equally heavy; white crests at the angles; surface shagreened; bluish green, turning dull purplish; size .8 × .6 × .5 mm.

Stage I. Head rounded, bilobed, flattish before, erect, not notched, brownish ochraceous, not shining, a little white frosted before; ocelli and jaws black. Body moderate, rather stout, normal, equal, segments slightly widened posteriorly and coarsely annulate. White; a broad, subdorsal vinous-brown band, joined to a single broad dorsal one on joints 10–13; a similar single ventral band, broken about the feet on joints 2–4; feet of joint 10 vinous, of 13 ochraceous, thoracic feet pale. Tubercles small, dark, normal; setae short, dark, very minutely capitate.

Stage II. Head slightly bilobed, flattened before, held flatly, luteous with brown dots in vertical rows, more distinct above; width .5 mm. Body moderate, even, greenish, the dark brown subdorsal and ventral stripes as before.

Stage III. Head broad, flat, held flatly, all dark purplish shaded and dotted, leaving two erect obscure pale sordid lines and a broad lunate band of pale above the mouth; width .8 mm. Body marked as before but filled in with sordid purplish shadings; sides broadly dull greenish, venter and feet dark. Faint narrow pale lines of whitish, addorsal and subdorsal ones the most distinct.

Stage IV. Head gray above with vertical lines of black dots, black on the face surrounding the transverse lunate pale gray bar over the lower part of clypeus; width 1.4 mm. Body moderate, smooth, dark gray dorsally with faint irregular pale addorsal and subdorsal lines; subventer broadly greenish, pale with dark spots on tubercles vii; venter diffusely dark brown. Tubercles black, conical.

Stage V. Head rounded, flattened especially below, held flatly; black, dull on the faces of the lobes, a broad white triangle below over clypeus and above anteriorly reaching up along the median suture; else gray brown, the lobes with vertical rows of oblique black spots in two rows alternating; antennae reddish; width 2 mm. Body cylindrical, normal, thorax depressed, tubercles elevated, tubercle ii of joint 9 especially high forming a pair of black papillae. Anal flap triangular, produced; a pair of subanal cones. Black-brown, reddish brown shaded, no defined lines; a light whitish space dorsally on joints 5 to 7, illy defined, narrowed between the segments, appearing again on joints 10 to 12 less broadly. Venter more ocherous shaded with irregular blackish spots and streaks; lines pale and broken, crinkled, obscure.

Stage VI. Head quadrate, flattened, thicker at the vertex, slightly roundedly bilobed; sordid luteous gray before, a bicusped yellowish white band reaching over the clypeus; above darker gray with obscure straight vertical light streaks, the pale patch and black spots of former stage both absent; a slight darker line on upper angles of lobes; ocelli dark; width 2.8 mm. Body straight, stick-like, roughened by the anal cones and subpapillose dorsal tubercles, of which tubercle ii of joint 9 is much the largest. Back brown, mottled with subdued whitish and gray-black. Irregular light dorsal areas on joints 5 to 7, widest on joint 5 and on joints 10 to 12; joints 8–9 nearly black dorsally and an irregular blackish subdorsal band, rather broad. Sides broadly blackish shaded, leaving the venter narrowly pale. Feet of joint 10 large, pale wood brown, a black ring near the base and many small white dots above; feet of joint 13 dark like the sides. Thoracic feet pale, appressed. All finely mottled and dotted; tubercles black; spiracles black ringed.

Cocoon of coarse silk. Eggs from Washington, D. C., May 29; mature larvae July 21; first moth issued August 7. The larvae were fed on rose leaves. Probably they will eat a variety of food plants. The pupa is dark brown without any noteworthy characters.

NEW ACRIDIIDAE FROM THE SOUTHERN STATES.

BY ALBERT P. MORSE, WELLESLEY, MASS.

SEVERAL previously unnoted members of this family were taken in the summer of 1905 during a second trip in the South under the auspices of the Carnegie Institution of Washington.

Nomotettix cristatus denticulatus var. nov.

This variety, for it is unlikely to be more than that, is more scabrous than the type form, with the margins of the pronotum very minutely serrulate, sides of the vertex of the headless regularly convex, its carina less protuberant, the carina of the pronotum thinner and higher, the middle femora with undulate margins, and the upper edges of the hind femora usually with inwardly or upwardly directed denticulate processes.

Six males, one female; Caddo, Haileyville, So. McAlester, I. T.; Denison, Tex. Aug. 6 to 13.

Hippiscus immaculatus sp. nov.

The specimen under consideration is the size of *H. rugosus*. The pronotum is less rugose, smoother in outline and in surface, a little narrower; the hind margin slightly obtuse-angulate, its sides straight and its apex rounded. Wings like those of *rugosus*, the tip infuscated but not maculate. Ground-color of tegmina a pale, almost vinaceous, brown; the basal half of the anal field suffused with fuscous except along the anal vein; the distal half of the costal field more or less suffused and the basal third finely maculate, the proximal part of the discoidal field evenly suffused, the veins and venules of the distal part more or less infuscated apically, and a slight fuscous suffusion near the base.

Compared with *rugosus* the specimen differs relatively little structurally or in wing-marking, but radically in the tegminal pattern which suggests that of *tuberculatus* but is much less distinct.

One male, Clarendon, Tex., Aug. 18.

Podisma scudderi sp. nov.

Head large, eyes large and prominent, vertex very blunt, but little protuberant,—in form and proportions recalling Dendrotettix. Pronotum robust, depressed rather than compressed, especially at the shoulders, carina distinct on metazone, evanescent on prozone, posterior margin slightly convex, sub-emarginate, sutures deeply impressed. Prosternal spine short, acutely pointed, conical with excavate sides. Tegmina ovate-lanceolate, separated by their own width, anterior margin strongly convex, posterior slightly so, apex evenly rounded. Carina of abdomen indistinct. Valves of ovipositor stout, outer margins finely dentate and strongly sinuate, contrasting markedly in robustness with the same organs in *P. glacialis variegata*, from which the presence of tegmina distinguishes it at a glance.

Color luteous beneath; above mixed olive green, fuscous, and brown, with more or less cherry red on inner and outer faces of hind femora. Feet greenish, tibiae varied, strongly pubescent, with black spines. Length: 25; hind femora: 12; pronotum: 5; tegmina: 4 × 2.5 mm.

One female, Cheaha Mt., Ala., July 13, 2300 feet.

This is a stout-bodied species, resembling Dendrotettix in the form of the head and proportions of the eyes, and the discovery of the male will be awaited with interest. The single example secured was taken while sweeping grass and shrubbery in the vicinity of Pulpit Rock, near the extreme summit of the mountain. Protracted search for a male or additional examples was unavailing.

I take great pleasure in naming this notable species in honor of Mr. Scudder, whose scholarly researches in orthopterology form the foundation on which all later study of the North American representatives of the order must be based; whose interest, example, and friendship have been a never-failing inspiration.

Melanoplus latens sp. nov.

Subgenital plate of male from above rounded apically, in side view short, its lateral and ventral outlines nearly equal, a little elevated apically. Furcula obsolete or represented by two small, rounded protuberances. Last dorsal segment a little emarginate. Cerci long, a little surpassing the supra-anal plate, two-and-a-half times or more as long as their basal breadth, nearly four times as long as their middle breadth, tapering rapidly on basal fourth, bent slightly upward at this point, sub-equal or slightly expanded sub-apically, tapering to a rounded, flattened apex. Valves of ovipositor of female short, rather blunt and usually dull pointed.

A short-winged, red-legged species having much the habitus of *M. scudderi* and occurring with it in thickets and woodlands. Tegmina acutely pointed, equalling head and pronotum. Vertex of head rather protuberant. Mid-carina of pronotum distinct, equally developed throughout. Prozona slightly inflated. Hind tibiae cherry-red.

Length: ♂, 19–22; ♀, 27–30. Hind fem.: ♂, 12–13; ♀, 14.5–16. Tegmina: ♂, 6.5–7; ♀, 7–8.5 mm.

Caddo, I. T., Aug. 9. Six males, seven females. To this species I refer also three females from Howe, I. T., Bonita, Tex., and Magazine Mt., Ark.

Melanoplus tepidus sp. nov.

This species most closely approximates *M. obovatipennis*, agreeing with it in size and general coloration, but may be distinguished from it by the following characters: — Sub-genital plate of the male feebly but distinctly tuberculate sub-apically; the upper valves of the ovipositor of the female narrower at base in side view; the pronotum is more elongate and slightly inflated, its sides and top slightly convex instead of straight, its lateral lobes less deep, and the longitudinal fuscous stripe thereon broader anteriorly, of nearly equal width throughout, covering one-half or more of their depth; the tegmina are slightly more elongate, the eyes of the male are large and very prominent, and the vertex of the head narrower, more prominent, and rather deeply sulcate.

Three males, three females; Meridian, Miss., July 16.

Melanoplus tribuloides sp. nov.

Similar to *M. tribulus* but with the digits of the furcula much wider and longer, flattened, from enlarged bases, in length equalling or exceeding the middle breadth of the cerci; the cerci narrower in the middle.

Two males, three females; Cheaha Mt., Ala. 2000–2400 feet.

One male, two females; Turnipseed's Ranch, 1000 feet, near base of Cheaha Mt.

Melanoplus tuberculatus sp. nov.

A rather small, inconspicuous species, long-winged, flavescent brown in color, with unspotted tegmina, faintly barred hind femora, and very pale yellowish green hind tibiae. Fuscous stripe of the lateral lobes of the pronotum restricted to the prozona, brownish, sometimes obsolete. Sub-genital plate of the male seen from above smoothly rounded posteriorly, its ventral outline from the side smoothly convex, terminating posteriorly in an upwardly directed, acute, sub-apical tubercle, the lateral margins ampliate at base. Last dorsal segment of abdomen of male emarginate at origin of furcula, the latter consisting of a pair of short, triangular, flattened processes from expanded bases on the segment, scarcely as long as the segment, parallel, and widely separated. Cerci short, but little longer than their basal width, wide and very stout at base, tapering rapidly, the apical half sub-equal, tapering to a rounded apex, bent strongly upward and inward, the apex flattened and a little reflexed. Tegmina a little surpassing (♂) or about reaching (♀) the hind knees.

Body: ♂, 18–22; ♀, 19–27. Tegmina: ♂, 14–18; ♀, 16–19. Hind fem.: ♂, 11–12; ♀, 13–15 mm.

Eleven males, three females; Quanah, Texas, Aug. 21.

One male; Wichita Falls, Texas, Aug. 15.

Melanoplus scudderi latus var. nov.

Two males from Bonita, Texas, which I refer to this species with some doubt, possess exceptionally broad cerci, the depth nearly or quite equalling the length, the lower margin very strongly convex. To this form I apply provisionally the varietal name *latus*.

THE SWARMING OF CULEX PIPIENS.

BY FREDERICK KNAB, WASHINGTON, D. C.

It has been the writer's good fortune to observe the swarming and mating of *Culex pipiens* upon four consecutive evenings, October 15–18, 1904. Many notices of the swarming of Culicidae and related forms have appeared, but most of the accounts deal with the swarming simply as a remarkable phenomenon while its significance escaped them. It therefore seems worth while to record my own observations. Following these I shall give the more interesting data of previous writers, and at the end, a bibliography of the subject.

My observations were made at Urbana, Illinois, under exceptionally favorable conditions. Although the country about Urbana is well drained and there is but little water, mosquitoes were remarkably abundant. As far as could be determined all came from one source. On the outskirts of the town is a small stream, known as the Salt Fork, which, during dry weather, becomes practically stagnant. About a mile up the stream the water was polluted by the discharge from an abattoir. The foulness of the water was such that the fish normally present in the stream were all destroyed and thus an ideal breeding-place for mosquitoes was created. Early in October the writer found the larvae of *Culex pipiens* present in immense numbers, and when the shrubbery bordering the stream was disturbed the imagos rose in great clouds. These mosquitoes, however, showed no inclination to leave the waterside and would quickly return to the shelter of the marginal vegetation.

October 15 was a warm autumn day and its close was marked by one of those clear calm evenings when not a leaf stirs and the air appears to be perfectly still. At five o'clock the writer was crossing a corn-field not far from the stream. The sun was already near the horizon and its direct rays were cut off by an intervening line of tall trees. When near the middle of the field a cloud of mosquitoes was noticed directly overhead. The lowest mosquitoes were about the writer's head and shoulders, the topmost ones perhaps five feet higher; the transverse diameter of the swarm was about two feet. The high-keyed piping, vibrating between two notes in constant rapid reiteration, was very distinct. The variations in tone seemed to correspond to the upward and downward movements of the individuals. In the light of the succeeding observations it would seem that this swarm had been forming above the writer's head from the time he entered the field. The swarm was watched for about twenty minutes. The individuals in the swarm flew up and down amongst each other with a kind of weaving motion — a downward and forward plunge and back again, performed without unison or regularity. The movements were sufficiently slow to allow the plumed antennae of the males to be clearly distinguished and it appeared that the swarm was composed wholly of males. Once a female was seen to dash into the midst of the swarm and emerge on the other side united with a male. The insect-net was swept through the swarm a number of times. At each stroke the mosquitoes would disperse somewhat but returned at once to their former position and continued their dance, and there was no perceptible diminution of their numbers. An examination of the captures showed 897 males and four females. This count includes the female observed passing through the swarm, as narrated above, and it is obvious that the other three females in the capture are not to be considered as members of the swarm. They may have entered the swarm unnoticed in the manner described, or they may even have been hovering about outside of it. The observations of T. H. Taylor (in Miall & Hammond, The Harlequin Fly) show a like condition in Chironomus. On a still evening his captures from a swarm were 700 males, no females. On a windy evening, when the swarm was thrown more or less into disorder by the breeze, a capture of 4300 specimens included 22 females.

Upon turning to leave the mosquito-swarm another one was discovered close by, hovering over and about a corn-stook. The swarm extended about half way down the side of the stook and kept on the south side of it, the mosquitoes all facing northward. Although there was no perceptible breeze it was thought that the attitude of the mosquitoes was in response to a current of air and subsequent observations confirmed this supposition. It was but seldom that one of the mosquitoes alighted on the corn, and as in the cloud first observed, all appeared to be males. A round of the field showed that each corn-stook had its swarm of mosquitoes, and furthermore, single stalks that remained standing had small swarms dancing over them — sometimes of only six or eight individuals — and the bushes and small trees on the edge of the field had their swarms. In every case the mosquitoes faced northward and the swarm kept on the south side of the object of attraction. Always the mosquitoes gathered over some prominent object such as a tree or a projecting branch, a bush, a corn-stook or a person. In this last case the swarm would move with the person and the only way to get rid of it was by passing under some taller object where the swarm would then remain.

On the following evening at five o'clock the field was again visited. Upon approaching the region of the creek swarms of mosquitoes were noted over every tall object — at the tops of telephone-poles, orchard-trees and shrubbery. On a very tall elm, standing alone in a pasture, a swarm was dancing before a projecting branch

In the corn-field the swarms were found, as on the evening before, over every prominent object and as the writer entered the field a swarm immediately began to form over his head. This time, however, the position of the swarms in relation to the objects was the opposite of the evening before — the mosquitoes were now all facing southward and they kept on the north side of the objects. The trees on the south side of the field, some of them 25 or 30 feet high, had immense clouds on their north sides. As on the evening before, there was no perceptible breeze but the drift of smoke showed that there was a current of air from the south. Station was taken near the row of trees bordering the field and some swarms dancing before projecting limbs kept under observation. Repeatedly females were seen to issue from the foliage, dash into the swarm, and emerge united with a male. When in copula the male and female face in opposite directions, their bodies in a horizontal plane; the female dragging the male after her.* The pair (or rather the female) would fly upward for a while and then slowly drift towards the ground. Once a pair in copula was seen to issue from one swarm and plunge into another swarm close by. The pair made great haste to extricate itself while the swarm was immediately thrown into frantic excitement and the mosquitoes danced up and down at a furious pace for some time, until at last the ordinary measure of speed was regained. With the growing darkness the excitement in the swarms increased and the movements became more rapid. Few successful unions now took place. Females entering the swarm would be pounced upon by two or three males, and together, tumbling over each other, they would fall to the ground and there separate. Towards the last no more females appeared and with the increasing darkness the swarms rapidly diminished, the males flying off into the air.

At five o'clock on the following evening the swarms were found as before, dancing over every object projecting above the general level. Single mosquitoes were seen flying rapidly and straight. These looked larger than the dancing males and when captured proved to be females. The air was again very still with a current from the south and, as before, the dancing males faced towards it and kept on the opposite side of the objects. The west side of the field was bounded by tall trees and high up on these, at least fifty feet from the ground, before projecting branches, clouds of mosquitoes could be distinguished while lower down on these trees there were none. Station was taken at a corn-stook to determine how long the dance would continue. As the darkness grew the numbers began to diminish, and at 5.50, when the darkness

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*Goeldi (Os mosquitos no Pará, 1905, p. 74, pl. I, fig. 3*a*) describes and figures the copulation of *Stegomyia calopus.* In that species the male clings to the under side of the female.

was almost complete, the last male flew away. The departing males flew upward and none of them alighted on the stook.

On the fourth evening the field was visited nearly an hour earlier than before. The sun was still shining and there were no mosquitoes present. Later, when the sun had disappeared behind the trees, the swarms were again present just as on the previous evenings. On this evening, however, there was quite a breeze blowing and the mosquitoes could not maintain their position over the projecting objects and swarmed altogether on the leeward side of them. Otherwise their behavior was much the same, only that the freshening wind occasionally threw the swarms into confusion and greater activity. Rain and cold weather followed the next day and put an end to further observations and presumably to the swarming.

There are many records of swarms of Culicidae and related forms, although in many cases there is no exact indication of the identity of the insects in question. I am convinced that all such records, in so far as they refer to swarms of the nature described above, apply to Nemocera and probably in every case either to Culicidae or Chironomidae. I believe that these swarms of dancing males, congregated for sexual intercourse, are peculiar to the Nemocera. Many of the records from untrained observers, called forth by the appearance of these Diptera in extraordinary numbers, though incomplete, are nevertheless of interest. In nearly all of them the fact that the swarming leads to sexual union has been entirely overlooked.

Moufet, in 1634, already speaks of these swarms and notes how they gather at the gables of houses and over the heads of people passing over bridges. It should be noted that in his chapter "De Culicidum" the Culicidae and Chironomidae are not distinguished, as indeed has been the case with many a writer since.

The oldest record of the copulation of Culex appears to be that of the Spaniard Diego Reviglias, communicated to the Leopold-Carolinian Academy in a letter dated 4 March, 1728, but not published until 1737. Reviglias observed under the microscope, and described at considerable length, the sexual union and the copulatory apparatus of the mosquito. He treats his discovery as a very important one, which indeed it was in those days of lingering belief in spontaneous generation. However he does not mention swarming and there is reason to believe that he had before him a species which does not swarm — a matter which I shall take up again farther on. Later the French commander Godeheu de Riville also claimed as the first his observation of the copulation of mosquitoes, made on board his ship. The account is quite detailed and it is evident that in this case likewise copulation took place without swarming. I shall treat of this article more at length in another place.

Perhaps the earliest definite record of mosquitoes swarming is that by Swinton, published in 1798. Swinton describes some swarms which he, together with a friend, witnessed on August 20, 1766, in a garden at Oxford. The account has been drawn upon by later writers but I quote it here as it brings out very clearly the habit of congregating over prominent objects. There can be little doubt that the swarms in question were Culices as Swinton especially remarks upon the great annoyance caused that season by the bites of the unusually abundant "gnats." He relates that "about half an hour before sunset, such an immense number of gnats filled the atmosphere in which we breathe, as I had never seen before. We both of us also then observed six columns, formed intirely of these insects, ascending from the tops of six boughs of an apple-tree, * * * to the height of at least fifty or sixty feet. Two of these columns seemed perfectly erect and perpendicular, three of them oblique, and one approached somewhat towards a pyramidal form." He further relates that other swarms were seen in the vicinity on the same evening. In conclusion he states: "I have been informed by the Reverend Dr. Wyndham, Warden of Wadham College in this University, that, about thirty years ago, many columns of gnats were perceived to rise from the top of the steeple of the cathedral church at Salisbury, by a considerable number of people. He likewise declared, that these columns were seen both by himself and the Reverend Dr. John Clarke, then Dean of Salisbury; that, at a small distance, they resembled smoke; and that this at first occasioned a sort of alarm, many believing that the church was on fire."

There are a number of accounts of such swarms about church steeples causing alarm of fire. We have them from Germar (1813), Boll, Kirby and Spence, and Hagen. Boll records three such swarms. One of them on the steeple of the Nicolai church in Hamburg took place on a June evening at nine oclock. The discovery of the true nature of the apparent smoke, after the fire-department had been called to the spot, caused great merriment in the crowd of spectators. In 1807, when the St. Mary's church in Neubrandenburg served as a powder magazine, the sudden news that the steeple was on fire caused many of the inhabitants to flee precipitately from the city. As the column of smoke about the steeple did not increase, some courageous men finally ventured onto the tower and discovered that the source of alarm was an immense swarm of gnats. Another swarm was observed about the cross of this same church-steeple, at a height of 300 feet, on the afternoon of August 20, 1859. Hagen relates that dense swarms of gnats about the church-steeple at Fischhausen caused an alarm of fire which has earned for the inhabitants the nickname of "Mückenpeitscher." Koch has reported a swarm from the wings of a windmill, at a height of perhaps a hundred feet from the ground, curled by the breeze and resembling smoke.

Haliday states that *Culex detritus** occurs at Holywood, County Down, "in multitudes, during the day among hedges on the seacoast, in the evening in columns about the tops of trees, appearing like smoke at the distance of a furlong." Weyenbergh records two swarms of *Culex pipiens* from the vicinity of Haarlem, observed in 1857, dancing in perpendicular columns.

Mott gives an interesting account of an unusual gathering of gnats observed by him in 1879. As the article is not generally accessible and describes well the phenomenon, I quote it nearly in full. "On the evening of September 1st, between six and seven, after a fine, sunny day, the sky being clear, and the full moon just rising as the sun went down there was a grand festival among the gnats. Above the tops of the trees and hedge-rows in the low meadows north of Leicester these little Diptera were out in immense numbers. * * They assembled in groups of various shapes, sometimes a vertical column from 6 ft. to 20 ft. high, and 1 ft. to 3 ft. diameter, rose from a tree top like a pillar of smoke. Sometimes a sheet 4 ft. or 5 ft. high and 10 ft. long hung above the hedgerow, but seemed never more than a foot or so in thickness. The following evening, at the same hour, the sky being more clouded, a few gnats only were to be seen; but on the evening of the 6th, with the sky again cloudy, there was a still more remarkable display of gnat life. The little creatures were out again in millions, but this time the vertical column formation was adopted by nearly the whole of them. These columns rose from the hedges on either side of the road, and were visible for half a mile a-head at irregular distances, averaging, perhaps, 21 ft. or 15 ft. They formed an avenue of such a singular and unusual appearance that everyone who passed along the road paused at intervals to watch and wonder at them. This piece of road is about half a mile long, on the top of an embankment which carries it over the low meadows and the river. At the farther end there are a number of trees, and from the top of nearly every tree three or four of the strange, smoke-like columns could be seen standing up in the air, always straight but not always vertical, some of them being inclined at small angles. * * * On watching one of the columns closely, it was apparent that all the gnats had their heads one way, facing the breeze, which, however, was a very light one. It was a calm evening; what air-current there was came from the south-east. It seemed to be sufficient occasionally to press back the column a few inches from its normal position, and whenever this happened the whole body of gnats jerked themselves forward again with one perfectly synchronous impulse."

A picturesque account of a remarkable swarming of Culices, at Lewisham Road

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*Haliday's *Culex detritus* greatly resembles the common *Culex pipiens* and most probably the observation should be credited to the latter species.

near London, is given by Douglas. During ten days he observed "the air thick with millions of them, at times charging in close column up the road, like a squadron of cavalry, at other times engaged in dancing up and down, after the manner of their race." These swarms were in evidence only during the hour before dark and it appears were over or near the road, within reach of the riding whips and sticks of the "*profanum vulgus.*" Near by "are several tall trees, and round the top of the highest one only, at the same hour of the evening that the periodical saltatory performances are going on in the road, enormous swarms of gnats congregate. At first they appear as a small black cloud curling about the ends of the branches, and soon, when the air is calm, rising in a close column, like smoke from a chimney, for a distance of some 20 or 30 feet, the bulk gradually becoming more grey and attenuated until lost to sight in the upward progress. When a breeze is moving, the insects, always preserving close order, are blown out laterally, and after skirmishing with the wind return to their cover among the top leaves of the tree." This last remark may be an assumption and at such distance from the ground could hardly have been based upon actual observation. Douglas suspects that the species in the tree was "not the same as that of the acrobats of the road," and with right; unfortunately neither form was definitely identified. It further appears from the remarks of Douglas that these swarms are an annual occurrence, only that the number of individuals varies greatly from year to year.

In all the foregoing notes the writers failed to notice the true function of these gatherings of Nemocera. However it had not escaped that keen observer Gilbert White. He was evidently uncertain of the identity of the insects concerned, for in his posthumously published notes he calls them "*empedes* or *tipulae.*" Speaking of their swarms at evening he says: "At this juncture they sport and copulate; as it grows more dark they retire. All day they hide in the hedges. As they rise in a cloud they appear like smoke." No further mention of copulation in connection with swarming appears until Taschenberg's popular account of *Culex pipiens*, published in 1882. He notes their habit of gathering at the gables of houses and other prominences and describes how the females fly to the swarm of males to effect copulation. In the notes on the swarming of Chironomidae which follow, Taschenberg describes the formation over trees and in tall columns, and we are left to infer that the *Culex* swarms do not assume the columnar form — at least not in the same degree.

Theobald's brief, disjointed notes on the pairing and swarming of mosquitoes would hardly convey the correct impression to the lay mind. He corroborates Taschenberg's statement that in *Culex pipiens* the females fly to the males to copulate but he failed to note that the males congregate about prominent objects. The brief remarks on the swarming of *Culex cantans*, observed twice by Theobald in the fens, shows a distinct mode of swarming in this species. These swarms, composed of both sexes, formed dense clouds which quite darkened the air. "These insect-clouds were constantly moving up and down about ten to twelve feet above the ground. At times the noise they produced could be heard a quarter of a mile off, then it would suddenly cease for some time and commence again." It is to be supposed that Mr. Theobald is not to be taken literally when he says the insect clouds were constantly moving up and down but that the motion applies to the individuals in the swarms, as in the foregoing observations.

Radl has written two most interesting and suggestive papers on the light-reactions of Arthropods and a great part of his discussion is based on the behavior of swarming insects, particularly of Culicids and Chironomids. It would lead too far to enter into a discussion of these papers, but the fact is brought out that these insects orient themselves towards some definite object which is differentiated from its surroundings either by greater prominence or a difference in color. He not only cites instances of orientation towards trees, bushes, sign-posts, or even heads of grass, but others where the swarms hovered over paths through fields, or spots of different color but not elevated above the surroundings. The swarms over spots on the ground in all probability belong to different species from those attracted to prominent objects. Radl confesses that he made no attempt at close determination of the insects under observation and it is evident that he had no conception of the number of forms of similar but distinct habits that he might have before him. In consequence his statements are far too general and much that might have been used for or against his contention has escaped him.

Little as we yet know of the subject, it will be well to state right here that, even within the Culicidae, there is not only a marked diversity in the mode of swarming of different species, but that there are many forms which do not swarm at all. In the case of the almost exclusively house-inhabiting *Stegomyia calopus*, as Goeldi has shown, there are no such swarms as in *Culex* proper. The males congregate in little groups of 15 or 20, hovering over the corner of a cabinet or other prominent object, and pounce upon the females that come within range. I can add that copulation frequently takes place when there is no evidence of even such weak swarms. It should be noted that in *Stegomyia* copulation takes place during the brightest part of the day. On the other hand I have upon two occasions observed small swarms of *Stegomyia* (presumably males) hovering over the heads of persons, in both cases shortly before sunset. Once this occurred upon the hotel-veranda at Cordoba, Mexico, and again in the street at Acapulco, over the heads of passers and keeping along with them. In this case the meaning of the swarms would be hard to interpret.

Upon a recent trip to the west coast Dr. H. G. Dyar found a pair of *Culiseta consobrinus* in copula, resting on the under side of a board. This observation shows a wide departure from the short copulatory act of *Culex* and *Stegomyia.*

The crab-hole inhabiting *Deinocerites cancer* swarms during the short twilight period just outside the crab-holes and copulation takes place then.

Goeldi has given a vivid account of the swarming of the common house-mosquito of Pará which he designates as *Culex fatigans.* Swarming takes place indoors when it is nearly or quite dark and there are separate swarms of males and of females. Such peculiar mating-habits surely indicate a distinct species. In the case of our *Culex pipiens* the males are never found in houses — unless, indeed, they happen to come from larvae developed indoors.

Mr. E. A. Schwarz has kindly placed at my disposal his observations made on a species of *Culex,* probably the *Culex cubensis* of Bigot, at Cayamas in Cuba. The swarming occurred in the house, always on the side away from the sun, and when it was almost fully dark. The mosquitoes could only be seen against the sky, when between the observer and the open doors and windows and close observation was impossible under the circumstances. However, the swarms in this case were made up of both sexes and copulation freely took place. A capture of 60 specimens from such a swarm contains 44 males and 16 females.

In conclusion the curious reaction of a mosquito swarm to sound, related to Osten Sacken by a Cuban naturalist, seems worthy of notice. While a swarm of mosquitoes was hovering over the head of the observer a band was playing at a distance. Whenever the note A was struck the mosquitoes were all precipitated downward, striking against the face of the observer. A similar and quite independent observation is recorded by Howard.

The bringing together of these notes shows how very meagre our knowledge of this interesting subject is and it is to be hoped that it will stimulate others to further observations. No claim of completeness is made for the following bibliography. The works not seen by the writer are indicated with an *.

BIBLIOGRAPHY.

1634. Moufet, Tho., Insectorum sive minimorum animalium Theatrum, p. 82.

1737. Reviglias, Diego, De Culicum generatione. Acta physico-medica Academiae Caesareae Leopoldino-Carolinae naturae curiosum, v. 4, p. 14–18, pl. 1, figs. 1–5.

1760. Godeheu de Riville, Mémoire sur l' accouplement des cousins. Mémoires de Mathematique et de Physique, v. 3, p. 617–622, pl. 23.

1768. Swinton, John, Some Observations on Swarms of Gnats, particularly one seen at Oxford, August 20, 1766. Philos. Transactions, v. 57, pt. 1 for the year 1767, p. 111–113.

1802. White, Gilbert, The works in natural history of, v. 2, p. 215–216, 235–236.

1813. Germar, E. F., Dipterenschwärme. Germar's entom. Magaz., v. 1, p. 137.

1817. Germar, E. F., Mückenschwärme. Germar's entom. Magaz., v. 2, p. 336. [Chironomidae.]

1823. Kirby and Spence, Introduction to entomology, (3d ed.) v. 2, p. 4–6.

1833. Haliday, A. H., Catalogue of Diptera occurring about Holywood in Downshire. Entomological Magaz., v. 1, p. 151.

1833. Dale, J. C., Countless numbers of flies or gnats, dancing in a partly perpendicular column. Magaz. of Nat. Hist., ser. 1, v. 6, p. 543.

*1855. Koch, A., Der Todtenkopf (A. Atropos) und die Kartoffelkrankheit, und ein grosser Mückenschwarm in Sülz. Archiv d. Vereins d. Freunde d. Naturgesch. Mecklenburg, Heft 9, p. 189–191.

*1858. Boll, E., Grosser Mückenschwarm in Hamburg. Archiv d. Ver. d. Freunde d. Naturgesch. Meckl., Heft 12, p. 186; Heft 8, p. 135; Heft 13, p. 157.

1861. Hagen, H. A., Ueber Insektenzüge. Entomologische Zeitung. Stettin, p. 82.

1861. Osten Sacken, C. R., Mückenschwärme und Musik. Ent. Zeitung. Stettin, p. 52.

1871. Weyenbergh, H., Ueber Fliegenschwärme. Verhandl. zool.-botan. Gesellschaft in Wien, v. 21, p. 1201–1216.

1879. Mott, F. T., A festival of Gnats. Midland Naturalist, v. 2, p. 247–248.

1882. Taschenberg, E. L., Die Insekten, p. 231–233.

1889. Smith, W. W., Abnormal swarming of flies. The Field, v. 74, p. 824.

1890. Smith, W. W., Great flight of Culex, Tipula and Tetramorium in New Zealand. Entom. monthly Magaz. 2d ser., v. 1, p. 320–321.

1892. Osten Sacken, C. R., On the characters of the three divisions of Diptera: Nemocera vera, Nemocera anomala and Eremochaeta. Berlin, Entom. Zeitschr., v. 37, p. 437, 441, 453.

1894. Moffat, J. A., Mosquitoes. 24 Ann. Report, entom. Soc. of Ontario for 1893, p. 43–48.

1895. Douglas, J. W., Immense swarms of Culices. Entom. monthly Magaz., v. 31, p. 239–240.

1896. Williston, S. W., Manual of N. Am. Diptera, p. 23–24.

1900. Taylor, T. H., in Miall and Hammond, The Harlequin Fly, p. 183–184.

1901. Howard, L. O., Mosquitoes, p. 15–16.

1901. Radl, Em., Ueber den Phototropismus einiger Arthropoden. Biolog. Centralblatt, v. 21, p. 85–86.

1901. Radl, Em., Untersuchungen über die Lichtreactionen der Arthropoden. Archiv für die gesammte Physiologie, v. 87, p. 423–424.

1901. Theobald, F. V., Monograph of the Culicidae, v. 1, p. 65, 72–73.

1902. Goeldi, E. A., Os mosquitos no Pará. p. 34–35.

1902. Tutt, J. W., Migration and dispersal of insects, p. 105–106.

1904. Goeldi, E. A., Os mosquitos no Pará. Bull. Mus. Goeldi, v. 4, Fasc. 2, p. 50, 52–53.

1904. Smith, J. B., New Jersey Agric. coll. exper. stat., Report for 1903, p. 652.

1905. Goeldi, E. A., Os mosquitos no Pará. Memorias do Museu Goeldi, IV, p. 25–26, 73–75.

1906. Knab, F., Goeldi's "Os mosquitos no Pará." Journ. N. Y. entom. Soc., v. 14, p. 62, 67.

TO ALL INTERESTED IN ENTOMOLOGY.

The initial meeting of The Entomological Society of America will be held in New York City in connection with the midwinter meetings of the American Association for the Advancement of Science.

This society has been organized to meet the need of a national entomological society which shall represent all departments of entomology, and which shall hold a place in American entomology similar to that held in their respective countries by the great foreign entomological societies.

It is hoped that this movement will have the cooperation of all of the existing entomological societies in this country and that it will in no way interfere with the success of any of them. It is believed that a strong national society which shall bring together workers in all fields of entomology will tend to broaden the interests of each, and to strengthen the more special or local societies.

The amount of entomological work that is being done in the United States and Canada is great compared with what is being done in any other country; it is fitting, therefore, that the workers in this field should be united in a national society.

On another page there is given the report of the committee on organization; and an invitation is hereby extended to every one interested in entomology to join the society. Applications for membership may be addressed to J. H. Comstock, Ithaca, New York.

MELANOPLUS VIRIDIPES IN NEW ENGLAND.

This is the latest addition to the orthopterous fauna of New England. On June 14 Mr. C. W. Johnson took four examples, all males, at North Adams, Mass., at elevations of 1100 to 1400 feet on the foothills of Mt. Greylock. They were found resting on bushes in highland pastures and by the roadside.

This species has not been previously reported from east of Ohio. It matures very early, in June or possibly the latter part of May, and perhaps this is one reason why it has not been noticed before.

A. P. Morse.

THE PATTERN VARIATION IN THE PUPA OF *MELITAEA CHALCEDON.*— PLATE VIII.

BY LILIAN RAMSAY, STANFORD UNIVERSITY, CAL.

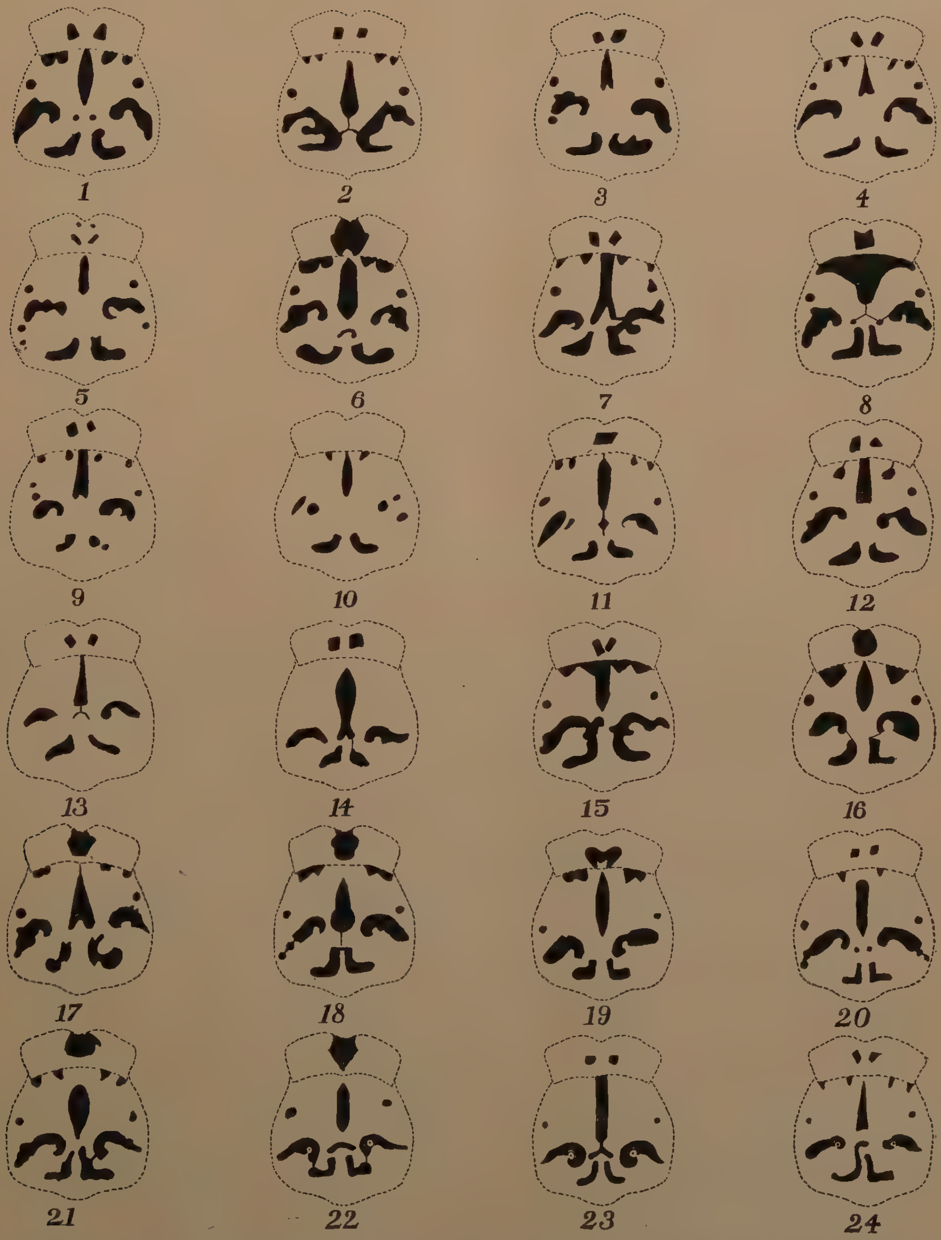
VARIATION in color pattern is familiar among adult insects. If color pattern is of advantage in the way of aiding insects, by protective resemblance, mimicry, warning, recognition, etc., in the struggle for existence, variations in the pattern are the material seized on by natural selection upon which new types of pattern and ultimately new species are built. That is, this is true if the natural selection theory of species-forming is true.

But insects have a struggle for existence in their immature stages as well as in adult condition and these young stages must be protected as well as the imaginal life. Are variations as numerous and as marked in immature characters as in adult ones? The assumption is, of course, that they are, but as a matter of fact there seem to be few specific proofs of this recorded in the large and rapidly growing literature of variation. As a simple contribution of definite data of variation in an immature character, I present the following brief statement and plate showing the variation in the pattern (black markings on a gray-green ground) of the antero-ventral half of the naked pupa of the checker spot butterfly, *Melitaea Chalcedon.*

The series examined included 127 pupae (chrysalids) obtained from as many nearly full-grown larvae collected at one time in one place on the University campus and reared to pupation in the laboratory. All the larvae were enclosed in a single breeding cage and hence all pupated under identical environment. The variations may be looked on therefore as blastogenic in character.

No two of the chrysalids have exactly the same markings. The pattern variation is typically continuous or gradatory, any two types being perfectly connected by gradatory inter-types. Hence no statistical tabulation of the variation can be made. The twenty-four types figured represent the range of variation and to some one of them can be referred approximately any chrysalid examined. But actually each figure represents accurately the pattern of only one particular specimen. The modal pattern is plainly of the type with numerous large strong blotches, like figs. 8, 16, 6 and the like, rather than of the less strongly marked type, as exemplified by figs. 23, 10, 13 and the like.

As these pupae are naked and wholly exposed to discovery by roving enemies they must depend largely for protection on a dissimulating color pattern. The variation in this color pattern must belong therefore distinctly to the class of slight, continuous variations that offer themselves as 'handles' for natural selection: that is, they must if any such class really exists.



Diagrammatic representation of variations in the color-pattern of the antero-ventral aspect of the naked chrysalid of the checker-spot butterfly, *Melitaea chalcedon.*

TRICHOGRAMMA PRETIOSA RILEY. OVIPOSITION,—A RÉSUMÉ.

ALEC. ARSÈNE GIRAULT, WASHINGTON, D. C.

LINTNER (1883), in Psyche, has given an accurate and somewhat detailed account of the oviposition of this minute and very interesting egg-parasite, which has also been copied *verbatim* in his second report on the injurious and other insects of the state of New York (Lintner, 1885). The host was *Pteronus ribesii* Scopoli, formerly *Nematus ventricosus* Klug.

This is the first account of its oviposition published, and although lacking in many details, the best one so far placed on record. Others have observed and briefly recorded this habit. Riley (1885), quoting Hubbard, states briefly that the mother parasite works chiefly by day, depositing two ova in each egg of *Alabama* or *Heliothis*; often, but a single adult emerged from the host eggs, and occasionally three were obtained. Nothing is said in regard to the manner of oviposition. F. W. Mally (1902), briefly states the manner of oviposition, with some details; probably he had not seen Lintner's account. The host was *Heliothis obsoleta* Fabricius, and the account is accurate so far as given. Finally, Quaintance and Brues (1905), give a brief, condensed account of its oviposition, as a result of recent studies. The following is but an enlargement of their account.

During the recent investigations on the cotton bollworm (*Heliothis obsoleta* Fabr.) by the United States Department of Agriculture, in Texas, during 1904 the writer had occasion, in studying its parasites in the laboratory at Paris, to make detailed studies on this species of *Trichogramma*, the most common and useful of the many parasites attacking that important pest. Hundreds of specimens were reared in confinement, and ample opportunity offered to observe its habits closely. As shown below, specimens were placed on the stage of the microscope, and there watched at leisure, while they ran busily about among the host eggs, depositing into them.

These observations but serve to confirm those made by Lintner; and it is through the kindness of Dr. L. O. Howard, Chief of the Bureau of Entomology, that the writer is able to offer these more detailed notes on this little egg-parasite. They are also offered as an addition to our knowledge of the habits of the smaller parasitic Hymenoptera, and to sum up, as it were, what is now known in regard to the oviposition-habit of *pretiosa*. Further results of the studies on this insect will be offered as time permits.

1. *General manner of oviposition.* This has been aptly described by Lintner (1883); details are here added.

Females taken from jars in which confined, several hours after emergence, were transferred by means of a camel's hair brush to a portion of a blade of corn upon which had been deposited, thickly, eggs of *Heliothis*, by moths also in confinement. The blade of corn was then placed on the stage of the microscope, and the insects watched, while they deposited egg after egg. These observations were repeated from time to time, with and without the aid of the microscope. The latter, however, was necessary, on account of the microscopic size of the insect.

When placed on the leaf of corn, the insects immediately began to crawl rapidly about, showing no indications that they were aware of the presence of suitable hosts, until they chanced upon one. At this, the female stopped and sensed the egg with its antennae, recognizing it. Searching is evidently the only way in which the insect finds its hosts, and in nature they doubtless travel many hours, at times, before finding a suitable place in which to deposit their eggs. After stopping and recognizing the host, and satisfying itself of its suitability, the female crawls upon it, and begins a minute, though rapid, examination of its surface with the brush-like clubs of the antennae, travelling generally, when doing this, transversely around the egg in a direction perpendicular to the polar ridges, and taking a variable, though short, period of time.

Becoming suddenly satisfied, she stops short, advances the length of her body, and raising the latter, applies the point of the ovipositor to the spot last sensed by the antennae. The tip of the abdomen now forms a caudal support, and the legs are well out and propped. Thus gripping the host egg, pressure is brought to bear on the ovipositor, which being resisted by the tough chorion, now bends and twists like a good rapier, which it much resembles in miniature. The parasite is now trying to force the ovipositor into the egg. In this it often fails (cf. 6), though generally successful. After its point has pierced the chorion, the ovipositor is slowly and firmly pushed in to its entire length, which is about half of the greatest diameter of the host egg, about 0.24 mm., or until the ventum of the female is in contact with the surface of the host.

Slight spasmodic contractions of the abdomen then ensue, doubtless sending the egg through the oviduct and ovipositor into the host, where it is deposited centrally. The ovipositor is then as slowly withdrawn, the female arching its abdomen very high, almost straining, until it is entirely out, when she regains her feet, and darts off in search of another egg, or simply changes position on the same egg, and repeats the operation; or else rests, according to circumstances. After beginning to insert the ovipositor, the antennae become non-vibratile, lying against the face; and in some observed cases, just as the ovipositor was wholly within the egg, the wings were lifted straight up over the body, perhaps to help in preserving a balance. The ovipositor is inserted always between the polar ridges on the host egg.

While engaged in oviposition, the female is very intent on her work, and is not easily disturbed. Indeed, large things do not seem to frighten or annoy these minute parasites, and no indication is given that they are aware of the presence of an observer, even when this presence is forced upon them. When they are sufficiently disturbed, however, they remain perfectly motionless, very seldom resorting to flight. On account of this apparent nonchalance, they are, in spite of their minuteness, very easy to breed.

2. *Oviposition in regard to time.* The time taken for single depositions averages about two (2) minutes, and is fairly constant in a large number of cases. The following observations were made on this point.

On June fourth, at 3 P. M., four females and one male, issuing from host eggs during the morning of the same day, were confined beneath a large bell-jar of convenient size, with eighty-one (81) fresh ova of *obsoleta* deposited in confinement during the afternoon and evening of June third, on a large piece of bristol-board. The latter was simply covered by the jar and the parasites then introduced.

After crawling about for several minutes, two (2) of the females found the eggs, and without hesitation, began to oviposit. They were so intent on their work, that the jar was removed and the individuals closely watched for a period covering two hours. This whole time they made no attempts whatever to escape, even showing no disposition to do so. They were so absorbed, indeed, that the piece of bristol-board was cut to a convenient size with a pair of scissors, and moved about freely, most of the time being on the stage of the microscope.

Oviposition was almost continuous for the first half-hour (3.00-3.30 P. M.), both females working actively. Then the paper was moved to the stage of the microscope. The parasites became perfectly motionless when this movement was made, remaining in their respective positions for another half-hour, doubtless, at first, slightly annoyed. At 4 P. M., one again began to oviposit, and soon the other joined her, though both showed tendencies to wander, or rest, and seemed to be more or less jaded. They continued thus until 5 P. M., when observations were suspended.

During the first half-hour, observations were made with a hand lens (aplanatic, triplet, ½-inch, Bausch and Lomb), but the latter was then discarded because the ovipositor, though visible, was difficult to follow, and the time of oviposition had to be judged in most cases by the movements of the insect. Hence, the time varied considerably as may be expected. The range was from fifteen (15) to one hundred and fifty (150) seconds, the smaller time-periods doubtless due to the fact that mere attempts to oviposit were mistaken for accomplishments of the act itself. With the lens, the following periods of time were obtained.

Deposition number.	Time, seconds.
1.	70.
2.	115.
3.	80.
4.	80.
5.	15.
6.	15.
7.	15.
8.	25.
9.	120.
10.	150.
10.	85.6, avg.

Observations with the microscope were made with the ⅔-inch objective, Bausch and Lomb, which was admirably fitted for the purpose. Every movement of the insect could be plainly seen, and therefore the time for each deposition could be accurately measured. The following time is to be accepted as that which is correct, obtained from many subsequent observations. The time was taken from the beginning of the insertion of the ovipositor.

Deposition number.	Time, seconds.
1.	120.
2.	120.
3.	150.
3.	130., avg.

From this, it is safe to say that two (2) minutes, more or less, is the average time taken to deposit a single egg. Individual differences cause the variation. From fifteen (15) to forty-five (45) seconds is normally required for insertion of the long ovipositor. (Vide seq., 6.)

3. *Faulty instinct.* This is doubtless present in some form in all insects. In *Trichogramma pretiosa,* when in confinement, some very interesting observations were made on this.

On the fourteenth of June, a single female without hesitation, oviposited twenty (20) times into infertile host eggs which were supplied her (Vide seq., 6). The eggs of the parasite hatched, and a generation successfully developed in these infertile ova. This being the case, it is doubtful whether or not this oviposition was due to faulty instinct, although the parasite was, seemingly, not conscious that the hosts were infertile. The fact is a very interesting one. It is worthy of note that these infertile eggs when thus parasitized, did not shrivel at all, but remained as full in appearance as fertile and normally developing eggs. The checks, however, shriveled completely.

On the first of October, a tenth reared generation of *Trichogramma* was obtained from infertile hosts under similar conditions.

On the morning of the twenty-fifth of June, the last of the newly emerged females of the third reared generation were found still wandering about the bell-jar under which confined, in search of fresh hosts in which to deposit; as there were only eleven (11) of the latter present, not already blackened by parasitism, it was highly probable that all of them had been deposited into.

In spite of this, the females were ovipositing continuously, refusing, in every case observed, the blackened hosts. To the contrary, depositing from three to five (3–5) times in the yet pale hosts. At times, these were refused.

In one of these pale eggs (which as stated, were also evidently parasitized but not yet blackened) which had been isolated, a female deposited about four (4) times; this egg turned black two (2) hours afterwards, proving beyond doubt that that female had oviposited into a host already parasitized about forty-eight (48) hours previously, as the black color does not appear until after the parasite's egg hatches, at this time of the year, slightly under three (3) days. It is probable that some of the pale eggs were not parasitized.

Hence, apparently, the female recognizes hosts which have already been deposited into, not until they have blackened, or by their color.

4. *Number of eggs deposited; calculation of the possible maximum number deposited.* The highest number of eggs observed to be laid was thirty-three (33). On the twenty-seventh of September, a single female issuing from *obsoleta* eggs collected on corn, in a small glass vial, at 3.40 P. M., was at once confined in another glass vial, closely stoppered, with portions of cotton leaves containing many ripe host eggs. She oviposited as follows.

Host number.	Time, P. M.	Number depositions per egg.
1.	3: 46	1; 1; 1 (4: 59); 1 (5: 02).
2.	3: 52: 30.	1; 1 (4: 58); 1 (5: 10); 1 (5: 12).
3.	3: 54–3: 55: 30.	1; 1 (5: 40).
4.	3: 56: 30	1.
5.	3: 58.	1; 1.
6.	4: 00.	1.
7.	4: 05: 30.	1.
8.	4: 50–4: 54.	1; 1.
9.	4: 57.	1; 1; 1; 1; 1;
10.	5: 13.	1; 1 (5: 43).
11.	5: 17.	1; 1.
12.	5: 20.	1; 1 (6: 05); 1 (6: 10).
13.	5: 25–5: 27	1; 1.
14.	6: 20.	1; 1. Final observation.

On July first, twenty-two (22) parasites emerged from hosts exposed to a single female; she therefore deposited at least twenty-two (22) eggs.

For other important observations on this, vide seq., 6.

From the fact that these observations were made under artificial conditions, that is, that the host eggs were supplied gratuitously, the female not having to search for them as they occur in nature, it is rather difficult to base calculations upon them. However, the following calculation is based on several apparent facts,— that the average time for single depositions is two minutes; and that, after females had been laying eggs continuously for a half-hour they appeared to be more or less exhausted, and deposition occurred at intervals of time only thereafter, for the space of about two hours. Hence the period of oviposition appears to be at its height during the first half-hour after commencement, and continues with more or less persistency for about two hours.

Without going into details, the average number of eggs for two hours would be sixty (60) eggs; and for one-half hour, fifteen (15) eggs. This calculation agrees with conditions found in confinement. Two females in the time of two hours, parasitized twenty-four (24) eggs, out of many supplied, averaging three depositions to a host. This would make thirty-six (36) eggs deposited by each. Repeated observations seemingly confirm this, and indicate forty (40) eggs, or less, as the average number deposited.

A calculation of the possible, but improbable and obviously absurd, maximum number of eggs laid, leads to the enormous number of one thousand and eighty (1,080). The average length of life of a female was here limited to two days, the average length of the period of oviposition to thirty-six hours, and the average time for single depositions to two minutes.

It is important to take into consideration the fact that in nature the host eggs are well scattered, and that the little *Trichogramma* has to take considerable time and much pains to find them. For such a minute insect, the examination of a whole leaf of corn is no small undertaking.

5. *Number of eggs deposited into single hosts.* This was determined both by direct observation and by rearing experiments.

By direct observation, much data was obtained but was hardly worthy because of the conditions prevailing in confinement. Females were observed several times to deposit as many as five eggs into a single host, but all of these did not successfully develop.

On this point, the following results were obtained by rearing experiments made in the laboratory at Paris. The hosts were obtained from corn and cotton.

Date, 1904.	*Host No.*	*Number parasites emerging.*
May 6th.	1.	4.
May 15th.	2.	3.
	3.	3.
May 16th.	4.	4.
	5.	1.
	6.	1.
	7.	2.
	8.	5.
	9.	3.
	10.	2.
	11.	4.
	12.	4.
	13.	2.
	14.	2.
	15.	3.
	16.	4.
	17.	5.
May 31st.	18.	1.
	19.	4.

Date, 1904	*Host No.*	*Number parasites emerging.*
May 31st.	20.	3.
	21.	4.
	22.	1.
	23.	4.
	24.	3.
June 12th.	25.	2.
June 27th.	26.	4.
July 23rd.	27.	2.
	28.	2.
	29.	2.
	30.	1.
	31.	2.
	32.	1.
July 30th.	33.	3.
	34.	4.
	35.	3.
	36.	3.
	37.	3.
	38.	1.
October 18th.	39.	3.
	40.	3.
Totals.	40.	111.

Average, 3.

It is thus seen that the number of adults issuing from a single host is not constant, but varies from one to five, averaging from two to three. The number also doubtless varies according to the species of host.

6. *Observations on a single female, bearing on the foregoing.* The following notes are derived from observations made on a single female, supposedly virgin, emerging from an egg of *Heliothis* between the hours of 12: 30 and 2 P. M., June 14. The observations continued until 6: 35 P. M., when the insect escaped.

a. *Faulty instinct.* At 3: 30 P. M., the glass jar containing this female was lifted and the insect transferred by means of a camel's hair brush, to a portion of a corn leaf on which had been deposited thirty-four (34) sterile host eggs. The leaf was transferred to a slide, and then placed on the stage of the microscope ($\frac{2}{3}$-inch objective, Bausch and Lomb).

It crawled about, not in the least disturbed, and soon found the hosts. At exactly 3: 33, oviposition began, or about one and one-half hours after birth. There were no indications to show that she was in any way conscious that the hosts were infertile.

Table showing activity in regard to oviposition.

Oviposition from	Resting periods	Number eggs deposited
3: 33–3: 47	3: 47–3: 48	
3: 48–3: 55	3: 55–4: 12	11 eggs.
4: 12–4: 27	4: 27–4: 35	3
4: 35–4: 44	4: 44–5: 40	3
5: 40–5: 42	5: 42–6: 08: 30	1
6: 08: 30–6: 18	6: 18–6: 35	2
Totals. 56½ minutes	125½ minutes.	20 eggs.

b. *Number of eggs deposited; number of depositions in single hosts.* The actual number of eggs deposited by this female, as shown above is twenty (20). Most of them were deposited during the first hour of the whole time during which the female was under observation, showing, or at least indicating, that by this time the insect was well tired out. This condition may have been brought on by the difficulty in this case experienced in inserting the ovipositor:

From 4:12–4:27 P. M., a period of activity as given in foregoing, the female, after depositing a single egg, made 17 futile attempts in succession to insert the ovipositor in as many places in the same host. Each attempt occupied from 15–35 seconds. Two successful depositions then occurred, followed by a period of 7 minutes rest, when another active period of 8 minutes ensued, during which, after depositing another egg, 3 more successive futile attempts to insert the ovipositor were made, all on the same host. Two successful depositions were then made in a different host. After this oviposition became fitful, but three eggs being deposited in the remaining two hours.

The exact cause of this inability to insert the ovipositor could not be ascertained from the nature of the case, but it was probably caused by weakness. The point of the ovipositor did not slip about during these attempts.

Out of the thirty-four (34) host eggs, but ten (10) were parasitized by this female. Nine of these were noted with especial reference to the number of depositions made in each. In the first host, four eggs were deposited; in the 2nd, 3rd, and 4th, 3 eggs; in the 5th, 1 egg; in the 6th, 2 eggs; and in the 7th, 8th, and 9th, 1 egg. The average for each host is therefore about two (2).

c. *Oviposition in regard to time.* The following time periods for single depositions were noted during these observations.

Deposition number.	Time, seconds.
1.	70.
2.	138.
3.	96.
4.	90.
5.	134.
6.	85.
7.	105.
7.	103, avg.

7. *"Effective" oviposition.* The following interesting experiments were performed to find when, or if ever, there occurred a certain advanced period in the development of the host at which it was immune from the effects of the oviposition of the parasite, because of this advanced development. For instance, perfect embryos just before exclusion from the egg. Can these be effectually parasitized? The hosts used in these experiments were all deposited in confinement.

a. On the 26th of September, six hosts showing advanced signs of development, were exposed to two females of *pretiosa* in a small glass vial. They were deposited into, and the resulting parasites successfully developed. A check lot of eggs from the same source and of the same age, hatched eight (8) hours afterwards. So oviposition was effective up to within eight hours of the exclusion of the host.

b. Two females and one male of *pretiosa* issuing from a single host on the morning of September 26th, were confined in a small glass vial with a piece of a cotton leaf containing four ripe ova of *obsoleta*, deposited in confinement, and now showing very advanced signs of development. A control lot of hosts present.

At 10: 22 A. M., *pretiosa* began to oviposit into the hosts. One of the latter received four (4) of the parasitic eggs, the second, two (2) eggs, and the remaining two, an egg each, when at 10: 38 A. M. they were removed to a separate vial by themselves. By 8 P. M. the same day, the hosts were still more developed, the black head of the embryo perfectly visible through the shell. On the following morning they had not changed, and development had evidently been checked. During late P. M., September 28th, they turned completely black from the effects of the parasitization. Eight parasites emerged from these four hosts during early October. The control lot of hosts hatched at 5: 30 P. M., September 26th, or seven (7) hours afterwards. Hence, oviposition effective up to within seven hours of exclusion of the host.

c. A female of *pretiosa* confined at 3:46 P. M., September 27th with nineteen (19) hosts, then hatching. Thirteen (13) of these hosts were successfully parasitized. A control lot of hosts hatching at 3 P. M., the same day. Hence oviposition effective up to within 4 or 5 hours, at the most, of exclusion of the host.

d. Five (5) hosts nearly ready to exclude, the perfect embryos visible, were exposed to a female parasite at 10:15 A. M., September 28th. One of the hosts excluded at 10:55 A. M. The other four (4) were blackened by the effects of parasitism by October first, or previously. These four yielded adult parasites later. Control lot of hosts excluding at 10 A. M., September 28th. Hence oviposition of *pretiosa* effective up to the moment of exclusion of the host.

These experiments strongly indicate that parasitization is successful up to the very moment of exclusion of the host, despite the fact that the perfect embryos of *obsoleta* are active and very capable of caring for themselves. They are not conclusive, however. Other experiments performed, indicate that when the host embryo is fully formed, parasitization is less successful than otherwise, doubtless due to the greater vitality of the embryo. Hence, there appears to be a certain period in the development of the host, the period between the perfect formation of the embryo and exclusion, in which it is partially, not totally, immune from attack.

8. *Length of the period of oviposition.* It was absolutely impossible to determine this under anything like natural conditions from the very nature of the case. From the evidence gathered in the laboratory, it is certain that the period of oviposition is very short, but it is not felt that this evidence warrants a statement of definite limits.

What conclusions are possible may be induced from what is said in regard to this matter on a previous page.

9. *Changes undergone by parasitized hosts.* After being parasitized, the host eggs retain their normal appearance, until the egg of the parasite hatches, when they become characteristically blackened, an opaque or dull bluish black. They still retain their normal shape and size, and the color persists indefinitely, always serving to distinguish eggs that have been parasitized. After the emergence of the resulting parasite or parasites, through a rounded hole in the side of the host egg, the color and shape still persist, and so on until the empty shell is destroyed through natural agencies. The black color comes on gradually, the host at first becoming dusky, finally opaque and black-blue. Infertile hosts are affected in the same way.

10. *Length of the egg instar.* If it is true that the black color of the host is due to the hatching of the parasite's egg, then the following table shows lengths of the period of incubation at different times of the season of 1904, as indicated by this

change in color. The periods are, of course, but approximately correct, and are probably worthless. It has been indicated, from time to time, that the period of incubation in *Trichogramma* is always several hours longer than that of the host, at any given date. By comparing the records for the periods of incubation of the latter as given by Quaintance and Brues (1905), page 52, and the table following, it is readily seen that this is not borne out by the facts.

TABLE OF THE EGG INSTARS AT DIFFERENT DATES, 1904.

Date hatched.	No. of observations	Length instar.		Date hatched.	No. of observations.	Length instar		Average.
		Days.	hrs.			Days.	hrs.	
May 30	6	3	5	Sept. 14	50	2	9	241 observations.
31	4	2	22	24	34	2	17	
June 7	30	2	22	28	9	2	12	
16	14	2	16	Oct. 1	33	3	17	71 hours, or 2.95 days, average.
17	3	2	13	5	5	3	18	
24	28	2	4	17	4	3	9	
25	9	2	14	19	12	4	0	

No records, unfortunately, were made during April, July and August, and late October.

BIBLIOGRAPHY.

1883. Lintner, Joseph Albert. On an egg-parasite of the currant saw fly—(*Nematus ventricosus*). Psyche, Cambridge, Massachusetts, IV, 1883–1885, pp. 49–50.

1885. Idem. On an egg-parasite of the currant saw-fly (*Nematus ventricosus*). Second report on the injurious and other insects of the state of New York, Albany, pp. 218–219.

1885. Riley, Charles Valentine. Fourth report of the U. S. entomological commission, being a revised edition of bulletin No. 3, *etc.* U. S. Dep. Agric., Washington, p. 103.

1902. Mally, F. W. Report on the boll worm, Austin, Texas, p. 30. (Agric. and Mechanical College of Texas).

1905. Quaintance, Altus Lacy and Charles Thomas Brues. The cotton bollworm. Bull. No. 50, U. S. Dep. Agric., Bureau Ent., Washington, p. 117.

THE ENTOMOLOGICAL SOCIETY OF AMERICA.

A meeting of the committee to organize a national entomological society, for which provision was made at the Philadelphia meeting of the Entomological Club of the A. A. A. S., was held June 28, 1906, in the entomological laboratory of Cornell University. The New York Entomological Society was represented by Mr. Carl Schaeffer, the Chicago Entomological Society by Dr. James G. Needham, the Jugatae (the Ithaca Society) by Professor J. H. Comstock, the Newark Entomological Society by Mr. J. A. Grossbeck, the Entomological Society of Ontario by Rev. Professor C. J. S. Bethune, and the American Entomological Society by Mr. J. Chester Bradley. At an adjourned meeting the Washington Entomological Society was represented by Mr. E. S. G. Titus.

The committee was organized by the appointment of Professor Comstock as chairman and Mr. Bradley as secretary.

The secretary then stated in brief the history of the present movement for the organization of a national entomological society. The parts of Mr. Lyman's two Presidential Addresses dealing with the organization of an entomological union were read and discussed. Discussion then followed as to the purposes for which such a society should exist and as to whether there was need for one. The opinion that there was such a need seemed to prevail, but it was urged that if the society be formed it should be based on broad and comprehensive grounds. It was then moved that it is the sense of this committee that the organization of a national entomological society is desirable. Every member in turn was called upon for an expression of opinion, and every one spoke in favor of the organization; but it was the feeling of the committee that the success of such a society would depend on the securing of cooperation of other societies as the Association of Economic Entomologists and the Entomological Club of the A. A. A. S.

It was suggested that provision might advantageously be made for committees on policy, as on education, on legislation, on museum methods, and on nomenclature.

Strong opposition was made to the formation of any independent code for entomologists; but it was believed that a committee on nomenclature might have legitimate ground for existence in voicing the peculiar needs of entomology in matters of nomenclature and in securing their adequate representation in the International Zoological Congress.

A sub-committee was appointed to draft a constitution and by-laws, which should embody the decisions reached by the committee, and to report them at an adjourned meeting.

The committee then discussed membership, dues, officers, elections and other matters. The decisions concerning these were subsequently embodied in the constitution and by-laws. The committee then adjourned until the following day.

At an adjourned meeting held June 29, 1906, the report of the sub-committee on constitution and by-laws was read and discussed. After the making of some changes the report was adopted, and the sub-committee was authorized to prepare and have printed a report of the committee together with the Constitution and By-laws, and to send them with an invitation to be present at the initial meeting of the society, to every entomologist in the country whose address could be learned, and to have them published in the entomological journals. The sub-committee was also authorized to call an initial meeting in New York City in connection with the mid-winter meetings of the A. A. A. S., to make arrangements for that meeting, and to transact such other business as may be necessary.

At a second adjourned meeting held June 30, 1906, it was decided to apply at once for affiliation with the American Association for the Advancement of Science, and such application was subsequently made.

J. Chester Bradley, *Secretary.*

The Entomological Society of America.

CONSTITUTION.

Article I.

NAME.

Section 1. This organization shall be known as *The Entomological Society of America.*

Article II.

OBJECTS.

Section 1. It shall be the purpose of this society to promote the science of entomology in all its branches, to secure cooperation in all measures tending to that end, and to facilitate personal intercourse between entomologists.

Article III.

MEMBERSHIP.

Section 1. The active membership of this society shall consist of two classes: *members and fellows.*

SECTION 2. All persons interested in entomology shall be eligible to membership.

SECTION 3. Members who have contributed to the science of entomology in some important way may be elected fellows of the society. The number of fellows shall not exceed fifty at any time.

Article IV.

OFFICERS.

SECTION 1. The officers of the society shall be a President, two Vice-Presidents, and a Secretary-Treasurer. The duty of these officers shall be those usually pertaining to their respective offices.

SECTION 2. The business of the society not otherwise provided for shall be in the hands of an executive committee consisting of the officers named in Section 1 and six additional members, who shall be elected by the society. Four members of the committee shall constitute a quorum.

SECTION 3. The President shall represent the society upon the Council of the American Association for the Advancement of Science.*

Article V.

ELECTIONS.

SECTION 1. Election of Members. Nominations for membership may be made by any two members, and election shall be by Executive Committee.

SECTION 2. Election of Fellows. All nominations for fellows shall be signed by three or more members or fellows, and each nomination shall be accompanied by the following information concerning the nominee: name, address, occupation, branches of entomology engaged in, positions held involving entomological experience, entomological work done, and list of publications.

Election shall be by ballot at the annual meeting, upon nominations approved by the executive committee. Ballot may also be taken upon such other nominations, previously sent to the executive committee, as may be demanded by any five members or fellows. All elections of fellows shall require a two thirds vote of the members present.

SECTION 3. All officers shall be elected by ballot at the annual meeting, for a term of one year, and shall be eligible for re-election.

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* This section was adopted provisionally; it is to be included if affiliation with A. A. A. S. be granted.

Article VI.

MEETINGS.

SECTION 1. An annual meeting shall be held at such time and place as the Executive Committee each year may select.

Article VII.

AMENDMENTS.

SECTION 1. This constitution may be altered or amended at any annual meeting by a two thirds vote of the members present, a copy of each amendment proposed having been sent to members and fellows at least one month in advance of the meeting.

BY-LAWS.

1. The annual dues for members and fellows shall be one dollar.
2. A majority of the members present at an annual meeting shall constitute a quorum for the transaction of business.
3. Notice of all meetings of the society shall be sent to members at least one month in advance.
4. The Executive Committee shall provide a program for all meetings, including at the annual meeting, a popular lecture, and a technical entomological exhibit of material and methods.
5. The time of the business meeting shall be published prior to the opening session of the annual meeting.

THE GROWTH OF INSECT BIONOMICS.

The interesting suggestions for observation and collecting which are embodied in the now-issuing new edition (third) of the "Anleitung zu Wissenschaftlichen Beobachtungen Auf Reisen" edited by Professor von Neumayer do not, I am glad to notice, omit attention to the ethologic or bionomic aspect of natural history. In the chapter given to Arthropods, revised by Dr. L. Reh, section *H*, devoted to special hints for observation, is composed of a series of most suggestive paragraphs successively entitled polymorphism, parthenogenesis, varieties, protective resemblance, mimicry, terrifying means, weapons, death-feigning, autotomy, regeneration, directive marks, interrelations with other animals, parasitism, plant injuries, galls, etc., benefits and injuries to man, pollination of flowers, care of the young, instincts, special habits, etc., luminosity, and sound-making. In these paragraphs a glimpse is given of the fascination of the bionomic study of insects, and of the wonderful opportunities for illuminating new observations. Such observation or study need lack nothing of the exactness or detailed character of morphologic or systematic work. It is too commonly assumed that ecology, ethology, bionomics, etc., are synonyms for fads, for superficial observation and reckless generalization. In just so far as the study of insect bionomics is pursued carelessly it is worthless; pursued exhaustively, accurately and keenly it is immensely worth while. Folsom's book will help draw many entomologists into the alluring web of insect bionomic study. And this is a consummation devoutly to be wished. But don't give up the old habit of eye-straining exactness and utter fidelity to the minutiae of observation, as well as scientific caution in the formulation of generalizations.

VERNON L. KELLOGG.

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SOME COMMON ERRORS IN THE NOMENCLATURE OF THE DIPTEROUS WING.

BY S. W. WILLISTON, CHICAGO, ILL.

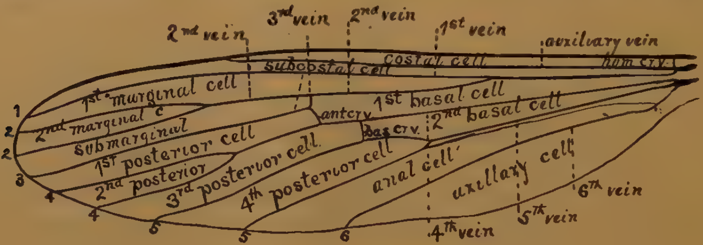
THERE are in common use two systems of nomenclature for the dipterous venation at the present time. A third, that proposed by Comstock and Needham, based upon comparative studies, has, so far, not received much approbation among students of the order.

The first and most commonly used of these systems is that given in detail by Loew in the first volume of the Monographs of North American Diptera; the second that adopted by Schiner in his later writings, and, since his time, by Wulp and Verrall especially, as also several other recent writers. Neither of these was the creation of the writers. That given by Loew was merely a codification of the usages of many of the early writers, especially Meigen and Wiedemann, with some additions and modifications proposed by himself. Schiner's system, likewise, was a rehabilitation, with modifications and additions, of the usages of various writers, notably the English, with some terms of the earlier continental entomologists. Loew's terminology was based chiefly upon the muscid venation, which he seemed to look upon as the more typical and primitive; he never attempted to apply his terminology to the nemocerous venation; in fact Loew never took enthusiastically to this division of the diptera. Schiner's system also was more especially applied to the brachycerous and muscid types, though he did attempt to homologize it with the nemocerous venation.

The application of neither system to the Nemocera has been altogether happy. Osten Sacken, when he came to use the Loewian nomenclature in the Tipulidae, was perplexed and led astray by some evident incongruities on Schiner's part, and his example has done more than that of any one else to perpetuate some very palpable errors, which, it seems to me, for the sake of consistency should be corrected—if either of these systems is to be used. Comstock and Needham did better, and their homologies are, for the most part, correct, I believe, though I am far from being assured that they have, in all cases, reached the correct conclusions, or that future researches will not modify the interpretations they have accepted for some of the diptera.

Schiner was the first to reach the conclusion that the 'fourth' longitudinal vein of the wing is the one which may be three-branched; and that the fifth is two-branched only. The hind branch of the fifth is the one which Loew called the 'posterior basal cross-vein', but in this Loew was very clearly wrong; this hind branch is not a cross-vein in any sense of the word, and few writers have made use of the term since his time. The vein closing the anal cell in the higher diptera should be known as the 'posterior branch of the fifth vein.' The anterior branch of this vein is the one bounding the fitfh posterior cell, when present, in front, and is always present as a discrete vein in those wings having a discal cell in the vein separating the last posterior cell from the second basal cell. The two branches of this vein are conspicuously evident of course in many of the Nemocera without discal cell. Comstock, agreeing with Schiner, believes that the fourth vein (Vein V) is primitively three-branched, the proximal branch enclosing the discal cell, and, in nearly all cases he assumes that when but a single branch of the fourth vein is present it is the proximal one; a belief with which I do not at all agree. It is a singular fact that no dipteron, (unless it be *Lonchoptera*) presents a simple three-branched fourth vein unconnected with the fifth, and I am myself inclined to the belief that it is the fifth vein which is normally three-branched and not the fourth; and that the discal cell, when present, is not due to the proximal branching, but rather to the presence of a true cross-vein separating the second basal from the discal cell. I of course have not had the opportunity to study the venation of other orders of insects as had Comstock and Needham, but so far as my studies go, I find no conclusive evidence in them. If the fourth vein is three branched and discal cell present, the vein separating the discal from the second basal is of course the first section of the proximal branch of the fourth vein; if the fifth vein is really the one that is three-branched, then this vein, at the outer end of the second basal, is always a true cross-vein, which it always is in the Comstock system when the discal cell is absent. Schiner it was who, very strangely for so acute an observer, gave to the short vein at the outer end of the second basal cell in the nemocera the name of posterior or great cross-vein, and Osten Sacken, perhaps led astray by his authority at a time when he had not given much thought to the brachycerous diptera, applied to the first section of the anterior branch of the fifth the name of 'great cross-vein' in the Tipulidae. The name 'posterior' or 'great' cross-vein is applied to the cross-vein closing the discal cell outwardly in all the muscid flies. Now it is very evident that the absence of a discal cell, in the mosquitoes for instance, is not due to the coalescence of the discal and second basal cells, but to the absence of the 'posterior cross-vein' of the muscid and brachycerous flies, and the application of this name to the vein at the inner end of the discal cell is very clearly incongruous. My attention to this incongruity was first fixed by the common usage among students of the Culicidae in calling the vein at the outer end of the second basal cell the 'posterior cross-vein,' when it is very evidently homologous with the inner vein only, the 'anterior basal cross-vein' of Loew, and that is the name that should be given to it, if we are to use these systems of nomenclature. A moment's consideration will convince the observer that the real posterior cross-vein of other flies is present only in the Tipulidae and Rhyphidae among nemocerous flies.

Again, in all the brachycerous flies that have the third vein furcate, the cells situated between the second vein and the posterior branch of the third are generally known as *submarginal* cells, either the 'inner' and 'outer' or first and second, and of course, as in *Hyperalonia*, the third and fourth sometimes; while the cell between the first and second vein is known as the *marginal* in the Loewian nomenclature. In the Nemocera again, misled by Osten Sacken's perplexities, the invariable usage is to call the cell formed by the furcation of the *second* vein the *first submarginal*. In the exceedingly rare instances (*Protoplasta*, etc.) in which the third vein is supposed to be furcate in the Tipulidae Osten Sacken gave the name of supernumerary first posterior cell to the second submarginal. The culicidologists speak of the 'first submarginal cell' as being longer or shorter than the second basal; what of course is meant is the 'second marginal cell.'



Venation of Culicidae.

It is rather a curious fact, for which I can offer no explanation, that the second vein is never furcate among brachycerous flies, while on the other hand the third vein is, I believe, never furcate among nemocerous flies, with the possible exception of *Protoplasta* and its allies and *Psychoda* and *Pericoma*. We find, it is true, an apparent anterior branch of the third vein in many Mycetophilidae, Bibionidae, etc. But, I believe that in every such case this so-called anterior branch is in reality the second vein, which is *always otherwise wanting in nemocerous flies having a so-called branch to the third vein*. Comstock's homologies are here also more correct than is the common usage. A good example of this shortened second vein will be found in *Paltostoma* among the Blepharoceridae, and indications also may be found among many of the Stratiomyidae, where the second vein confessedly has assumed the position of a branch of the third.

It is perhaps rather a bold opinion, but I am, nevertheless, inclined to it, that the Phoridae are really members of the Nemocera. The venation of the family is quite identical with that of *Aspistes* of the Bibionidae, for instance, and is easily explainable on this assumption, but utterly impossible from any other. The fact that the Phoridae have two-jointed palpi, while all the Cyclorrhapha have but a single joint, eliminates them I believe absolutely from membership in that group. The only diptera, aside from certain Nemocera, having two-jointed palpi, so far as my observation and reading go, are the Leptidae, Stratiomyidae, Tabanidae, Pantophthalmidae, Bombyliidae, some Asilidae, Apiocera and the Phoridae. I am not sure about the Empididae. The phorid antennae do not seem to me to offer insuperable objections to the location of the family among the Nemocera. So far as I am aware the first antennal joint in these flies is supposed to be absolutely wanting, the second much reduced in size. Assuming that the so-called third joint is in reality the second joint, it does not require much imagination to conceive that the, at least three-jointed, arista is in reality the whole flagellum of the Nemocera. And we have the Orphnephilidae to help us out in this assumption, where practically the only difference is that of additional aristal joints. Schiner seems to have had the same idea in his association of the Phoridae next to the Bibionidae in his Fauna Austriaca. On the other hand it is a well-known fact that the most primitive antennae of all diptera, so far as the number of distinct joints is concerned, with a few exceptions only among the Cecidomyidae, are found in the Brachycera, not the Nemocera! I may add by way of postscript, that Theobald's interpretation of the Culicid venation in his monograph is incorrect, and betrays a limited knowledge of the venation of allied diptera.

ANNOUNCEMENT CONCERNING INDEX TO PERIODICAL LITERATURE.

Subscribers who have followed the bibliographic references published in Psyche will notice the omission of this department from recent numbers. This omission does not mean that the work of collecting references has been abandoned, but simply indicates a change in practice made necessary by the increasing scope of the bibliography, which has outgrown the space available for printing it. It has seemed inadvisable to increase the proportion of space for such matter, since that would involve the crowding out of valuable articles, and only a few of Psyche's readers — those to whom other and more complete indexes are inaccessible — would gain thereby.

Henceforth, therefore, the Index to Periodical Literature will not be printed in Psyche; but it will be maintained, and *copies will be furnished without extra charge to paid-up subscribers requesting such service.*

It is believed that this new move will enable the journal to present more and lengthier original articles, and more illustrations, than before, while giving even prompter service in bibliographic work.

The Editors.

NEMOBIUS PALUSTRIS BLATCHLEY.

This species has not been reported from New England, but I find it common in the vicinity of Wellesley in suitable localities. I have Massachusetts specimens from Dover, Oct. 11; Natick, Oct. 16; Wellesley, Sept. 6, 27; and Connecticut examples from So. Kent and Canaan, Aug. 18 and 19. The latter were referred to *N. carolinus* by Scudder (Journ. N. Y. Ent. Soc., iv, 107–1896).

It is a tiny, shining dark brown or blackish species which lurks among the sphagnum moss of bogs and wet meadows and is common in suitable localities but captured with difficulty owing to its frailness and the character of its haunts. The most satisfactory method, after finding a station, is to spread the net and drive the crickets upon it.

Notes on its habits and habitats will be found in the Canadian Entomologist, xxxvi, 185 (1904) by Walker; and in the 27th Ann. Rept. Dept. Geol. Ind., p. 427, (1902) by Blatchley.

A. P. Morse.

THE DISTRIBUTION OF THE PERIODICAL CICADA IN NEW ENGLAND IN 1906.

In New England the Periodical Cicada (*Tibicen septendecim*) of 1906, known as brood VIII (Marlatt) is confined to portions of Plymouth and Barnstable counties, Massachusetts. I have attempted to find out, as nearly as possible, the area occupied by this insect in the two counties. The most northern locality seems to be the Manomet Hills, or "Pine Hills" as they are locally called, about five miles southeast of Plymouth. This is the only record I have from Plymouth county. In Barnstable county, it is more widely distributed. Mr. Arthur A. Heald, Supt. of Public Schools, of Wareham, in a letter dated June 27, says: — "At present all that I can speak of with certainty are the towns of Sandwich, Mashpee, Bourne and Falmouth. Mr. Joseph A. Cushman found them very abundant at North Falmouth, June 15; they were also very plentiful at Cataumet and Pocasset. Miss Delia I. Griffin, Curator of the Fairbanks Museum, St. Johnsbury, Vermont, found it in great numbers in the woods near Osterville; this is the most easterly locality from which it has been reported. It made its appearance during the first week in June, the third being the first positive date I have of its emergence.

C. W. Johnson.

ERRATA.

In Mr. Knab's paper on Deinocerites cancer, published in Psyche, Vol. XIII, No. 4, August, 1906, the following corrections should be made:

p. 97, line 11 from top, after Dyar *insert* &.

p. 97, line 6 from bottom, for usually *read* unusually.

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